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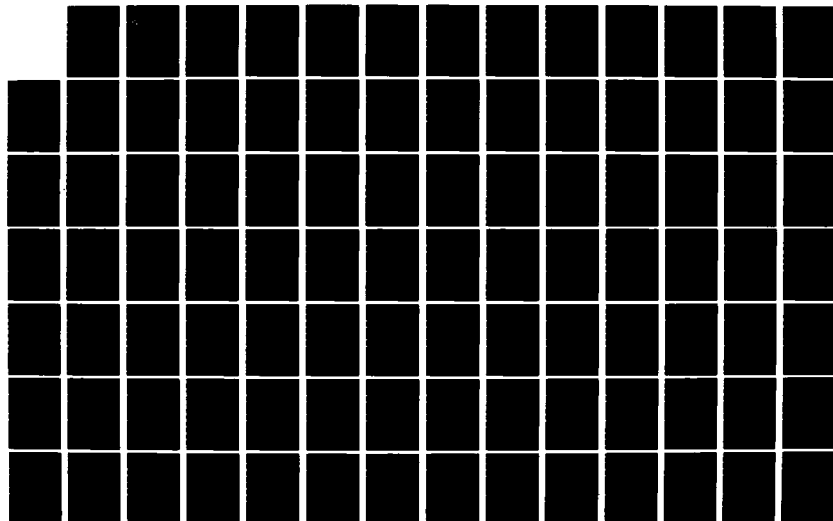
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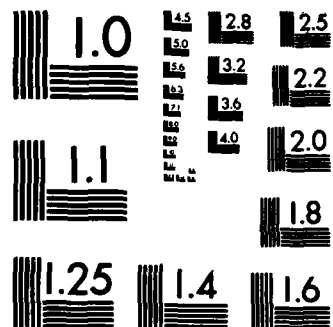
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NATIONAL COMMUNICATIONS SYSTEM

TECHNICAL INFORMATION BULLETIN

83-1

REPORT OF THE INTERNATIONAL TELEGRAPH AND TELEPHONE CONSULTATIVE COMMITTEE STUDY GROUP XVIII

GROUP OF EXPERTS ON ISDN MATTERS MEETING IN KYOTO, JAPAN

FEBRUARY 1983

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NCS-TIB-83-1	2. GOVT ACCESSION NO. AD-A127092	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Report of the International Telephone and Telephone Consultative Committee Study Group XVIII Group of Experts on ISDC Matters Meeting in Kyoto, Japan, February 1983.		5. TYPE OF REPORT & PERIOD COVERED Final
7. AUTHOR(s)		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS National Communications System Technology and Standards Office Washington, D.C. 20305		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS Same as 9		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
13. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Same as 9		12. REPORT DATE February 1983
		13. NUMBER OF PAGES 242
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release; Distribution Unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Annex to TIB reproduces preliminary copy of CCITT meeting report of Kyoto meeting.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) ISDN Telecommunications CCITT Data Networks Digital Networks		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Major technical and architectural aspects of proposed ISDN (integrated services digital networks) that are likely to impact Government telecommunications networks are discussed. Topics included are multiplexing of the data stream, channel structure, powering, networks numbering, and delays associated with out-of-hand switching. The complete preliminary report from the Kyoto meeting is reproduced in the annex.		

TECHNICAL INFORMATION BULLETIN 83-1

REPORT OF THE INTERNATIONAL TELEGRAPH AND TELEPHONE CONSULTATIVE
COMMITTEE STUDY GROUP XVIII GROUP OF EXPERTS ON ISDN MATTERS
MEETING IN KYOTO, JAPAN, ON 14-25 FEBRUARY 1983

APPROVED FOR PUBLICATION:

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FOREWORD

Among the responsibilities assigned to the Office of the Manager, National Communications System, is the management of the Federal Telecommunication Standards Program, which is an element of the overall General Services Administration's (GSA) Federal Standardization Program. Under this program, the NCS, with the assistance of the Federal Telecommunication Standards Committee, identifies, develops, and coordinates proposed Federal Standards which either contribute to the interoperability of functionally similar Federal telecommunication systems, or to the achievement of a compatible and efficient interface between computer and telecommunication systems. In developing and coordinating these standards, a considerable amount of effort is expended in initiating and pursuing joint standards development efforts with appropriate technical committees of the Electronic Industries Association, the American National Standards Institute, the International Organization for Standardization, and the International Telecommunication Union. This Technical Information Bulletin reproduces, with additional comments, the report of a meeting of the International Telegraph and Telephone Consultative Committee (CCITT) of the International Telecommunication Union which dealt with recommendations for the proposed integrated services digital networks (ISDNs). Comments or statements of requirements that would assist in the advancement of this work are welcome and should be addressed to:

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1. Purpose of This Technical Information Bulletin.

The purpose of this TIB is to inform Government offices of the status of CCITT recommendations relating to integrated services digital networks (ISDNs). ISDN service, the basic feature of which is the ability to support both digital and voice transmission, will start replacing conventional telephone and data service in some countries within five years. In order to allow development of standardized terminals and interconnection interfaces, the CCITT is attempting to complete the basic recommendations within the current CCITT study period, which ends in December 1984.

This TIB reproduces a preliminary copy of the report of a meeting of a group of ISDN Experts from Study Group XVIII which was held in Kyoto on 14-25 February 1983. Study Group XVIII is the group within CCITT that is charged with developing the overall system recommendations for ISDN. Other Study Groups, such as Study Group XI, which deals with signalling within telecommunication networks, take the advice of Study Group XVIII in developing specific protocols for use in ISDN. Because the final "working" plenary meeting of Study Group XVIII will be in July 1983, this report will form a substantial part of the recommendations of this study period. (Within CCITT, standards are referred to as recommendations. Although in the USA their use is voluntary, in some other countries their use by the public telegraph and telephone organizations is mandatory. As a practical matter, equipment that is to be sold or operated worldwide should conform to the recommendations.)

Because of the limited amount of time before the final plenary meeting during this study period, in July, the preliminary copy of the Kyoto meeting report is reproduced in this TIB; the final copy may not be available for several weeks. Except where the text is almost illegible, the pages are reproduced just as they were received at the meeting, with handwritten notes indicating changes made at the final session. Pages that have been retyped are marked: "[retyped by NCS]."

This TIB is arranged in two sections. The first section contains comments that are intended to summarize the major technical areas covered by the report and, in some cases, to point out the significance of these technical areas to requirements for Federal networks. The second major section, the appendix, is the preliminary copy of the report of the Study Group XVIII meeting in Kyoto. The second section starts with a table of contents, prepared by NCS, of the report.

2. Time Frame for ISDN Implementation.

Technical uncertainties and, probably, proprietary marketing considerations, cause the available information on implementation dates to be limited. However, it is expected that some European countries, such as the Federal Republic of Germany, will begin pilot installations as early as next year. The German system will probably have sufficient bandwidth to transmit digital television signals in addition to the ISDN digital voice and signalling channels. On this continent, Canada is expected to furnish ISDN services earlier than they are offered in the USA. In the USA, the vast existing telecommunications network, of high quality service and equipment, lessens the incentive to switch to the ISDN concept. There are indications, nevertheless,

that businesses in large cities may have some sort of ISDN service, perhaps without all the standard features, within ten years. Another area in which ISDN service may develop is within data switching networks that use cable television transmission paths.

The work of CCITT is organized into study periods of four years each, with all recommendations approved within a study period being published at the end of the study period. It is therefore necessary to complete basic ISDN recommendations within this study period so that telecommunication carriers and equipment manufacturers who are starting to design ISDN equipment can have some standards with which to proceed. Since the final plenary meetings (meetings of entire study groups, rather than subgroups) will take place in 1984, all substantive technical work should be finished in time for review at this year's plenary meetings. It is generally not acceptable to present new technical work at the last plenary in a study period because decisions significantly affecting equipment and system design need to be reviewed in detail by the member organizations at home in order to get inputs from all segments of industry. After a recommendation is approved at the plenary of the study group by which it was developed, it is passed to the CCITT Plenary Assembly for final approval.

Therefore, in summary, most ISDN recommendations by Study Group XVIII must be completed at the Study Group XVIII plenary in July 1983. There will then be approximately a year in which they can be reviewed in detail to catch on significant flaws. In about June 1984, recommendations against which no appreciable objections have been raised will be approved at the Study Group XVIII plenary and given to the CCITT Plenary Assembly, which will probably meet around November 1984. Except for very unusual and urgent cases, no new recommendations will be approved after that plenary until late in 1988.

3. Overview of Kyoto Meeting and Decisions Reached.

The Kyoto meeting was a meeting of the seven working teams of Study Group XVIII that deal primarily with ISDN matters; these working teams are listed in paragraph 3.1, below. These working teams were often broken into sub-working-teams in order to progress the specification of technical parameters in narrower technical areas. (For example, the powering sub-working-team was a part of the Basic Access working team.) Each working team prepared a report of its activities and accomplishments which was incorporated into the report of the Group of ISDN Experts. Significant areas of work by each working team are summarized in paragraph 3.1, and its subdivisions below, while more detailed discussions of some of the work areas are presented in paragraph 5. Paragraph 4 lists the draft recommendations prepared at this meeting; paragraph 6 is a table of contents of the meeting report which is reproduced in the appendix.

3.1 Seven Working Teams of the Study Group XVIII Group of Experts on ISDN Matters.

Working Team 1 dealt with customer accesses. The primary technical areas studied by this working team were related to the bit rates at the customer interface to the ISDN.

Working Team 2 dealt with basic accesses, level 1. "Basic access" refers to the basic service that it is presently anticipated will be supplied to an ISDN subscriber; that is, two switched channels at 64 kbit/s each and a signalling and data channel at 16 kbit/s. Level 1 refers to the first layer in the Open System Interconnection architectural model; this level includes parameters such as multiplexing structure of the channels, provision of electrical power, and voltage and current characteristics of the signal.

Working Team 3 dealt with network aspects of ISDNs. Discussed by this working team were topics such as connections types (e.g., bit rates, performance, and packet or circuit switched); addressing and numbering plans; and architectural models of protocol interaction between terminals and switches.

Working Team 4 dealt with services to be offered by an ISDN. The services fit roughly into three categories: Bearer services, which transport user data without necessarily needing to know its use or contents (however, data may not be transparent, as, for example, when echo cancellers are in the transmission path). Alpha services, which may interact more with the user data, as, for example, when the user interacts with an information storage facility within the ISDN. Telecommunication services; such as, telephony and teletex.

Working Team 5 dealt with signalling in the ISDN between the subscriber terminal and the network switch, between a private branch exchange (PABX) and the network, and between PABXs.

Working Team 6 dealt with switching aspects of ISDN insofar as they were concerned with the possibility of sending data packets to different subscriber channels and the possibility of circuit switching subchannels within a basic 64 kbit/s user data channel.

Working Team 7 dealt with developing an outline for the series of recommendations that will describe the ISDN.

In addition to the seven working teams, an ad hoc group worked on definition of ISDN terms.

3.2 Brief Summary of Some ISDN Technical Areas Having a Major Impact on Present Planning for Government Networks.

Following is a brief description of those topics that are of immediate concern to planners and managers of Government networks. More detail on these topics can be found in paragraph 5 of this TIB and in the complete report of the Kyoto meeting, which is the appendix to the TIB.

3.2.1. Time Division Multiplexing of the Basic Access Channels.

The bit rate for basic access will be 192 kbit/s at the terminal, which will be time division multiplexed to provide two user channels of 64 kbit/s each (the B channels), a signalling channel of 16 kbit/s (the D channel), and a 48 kbit/s channel for framing of the other channels and contention resolution between terminals that may try to use the transmission path simultaneously. The 48 kbit/s channel has some spare bits whose use is not yet specified, but, in general, it would not have to be transmitted between the user premises and

the local switch. The D channel (signalling channel) operates at 16 kbit/s in order to pass signalling information at a fast enough rate, but it is expected that there will be much spare capacity on that channel. The spare capacity will be available to the user for packet data, probably formatted similar the CCITT Recommendation X.25. A major feature of the presently proposed framing scheme is that it provides for a mechanism to resolve contention if more than one terminal attempts to transmit on the D channel at one time. The ability to resolve contention allows more than one terminal to be connected in parallel to the ISDN interface, much as telephone extensions are connected in parallel today. It is generally felt that as many as eight terminals can be connected in this manner, lowering the wiring installation costs in most cases. The ISDN requires at least four wires to connect each terminal--one pair for each direction of transmission. (More information on this topic is in paragraph 5.1 of this TIB.)

3.2.2. Channel Structure for Higher Bit Rates and For Private Branch Exchanges.

The basic service provision for two 64 kbit/s data channels and a 16 kbit/s signalling (and data) channel is obviously not adequate for either PABX connections or for services that require bit rates higher than 64 kbit/s. A so-called primary rate structure for PABXs was considered at this meeting. The decision, which at this point should be viewed as somewhat tentative, was that a structure of either 23 B data channels (at 64 kbit/s each) and a D signalling (and data) channel (at 64 kbit/s) or 30 B channels and 1 D channel should be standardized. ($24 \times 64 \text{ kbit/s} = 1,536 \text{ kbit/s}$; $31 \times 64 \text{ kbit/s} = 1,984 \text{ kbit/s}$.) For services requiring higher bit rates, there was a feeling that nx384 kbit/s would probably be suitable rates, but this will not be standardized within this study period. (More information on this topic is in paragraph 5.2 of this TIB.)

3.2.3. Numbering Plan.

Although the specific structure of an ISDN number will not be developed by Study Group XVIII, they will specify requirements for the numbering plans. At this meeting, several major features were agreed upon. First, the number will be composed of decimal digits; this causes some inefficiency in encoding over a hexadecimal structure, but was considered desirable from a user input standpoint. The structure of the number will be such that several public and private ISDNs in each country can be accommodated. The number itself will not carry routing information (specification of a private carrier such as MCI), but the signalling system will carry such information. (More information on this topic is in paragraph 5.3 of this TIB.)

3.2.4. Packet Switching Service.

There are two ways that a subscriber might obtain access to packet switching data service in an ISDN, but both ways may not be provided by all ISDNs. First, a B channel can be connected to a packet switch, either within the ISDN or outside it. In this case, signalling for the connection to the packet switch would take place over the D channel, much as a dial-in connection to private data networks today. Second, the space capacity of the D signalling channel can be used to connect to a packet network, which again can be either

inside or outside the ISDN. The protocol to be used on the D channel for packet switching applications has not yet been standardized, but much work has been done on a protocol very similar to that in CCITT Recommendation X.25, except that in ISDN the data link address field would have to provide for selecting one of several terminals that might be connected in parallel. The packet protocol for the B channel would depend on the packet switching network to which the user would be connected.

3.2.5. Delay Between Answer and Switch-Through of B Channel.

In ISDNs, signalling information will be carried in a channel that is separate from the data channel, whether the data channel carries digital voice or other digital data. Therefore, the signal from the called station back to the switch serving the calling station indicating that the called station has answered may not arrive at the calling station until after the first part of the digital stream from the called station arrives. This delay may be caused both by digital processor delays and by different routing paths. It is likely that the D (signalling) channel may follow a more indirect route than the B (data) channel. Since accounting for toll charging normally takes place at the switch serving the calling station, there is a possibility either of clipped speech (or data) or of fraudulent use by the customer. Users, such as the Government, that have automatic answering equipment will be especially affected by the clipping of the first few data bits. (More information on this topic is in paragraph 5.4 of this TIB.)

3.2.6 Powering the Terminals or Digital Telephones.

The most significant decisions related to power feeding are as follows: (a) An eight-pin connector will be the standard ISDN connector; its actual mechanical characteristics will be standardized by ISO (International Organization for Standardization). (b) Only four pins will be required for all ISDN terminals. Two will be for connections in the transmit direction and two for connections in the receive direction. Power to the terminal may be fed over these same four connections, using a phantom power feeding arrangement with center-tapped transformers. (c) Two of the remaining pins can be used for additional power feeding to the terminal. (d) The remaining two pins are reserved for power feeding from the terminal. This arrangement might be desirable when two terminals are connected directly, not through the network, as when a computer is connected to a peripheral. Standards relating to direct connection of two terminals will be developed by ISO, not by CCITT. (e) Certain carriers may elect not to supply any power to terminals, including digital telephones. In that case, the customer would have to provide the power, including emergency power. (European carriers are expected to supply at least 240 mw of power under all conditions for each ISDN basic service connection.) The section of the Kyoto meeting report dealing with powering is on pages A.050 and A.067 through A.074.

4. Organization of ISDN Recommendations.

Working Party 7 considered the general organization and outline of CCITT Recommendations dealing with ISDN. The conclusion was that a new series of Recommendations should be established for those recommendations that deal exclusively with ISDN. These recommendations will carry numbers in the format

I.ddd, where d is a decimal digit. Maintenance of specific recommendations will be assigned to Study Groups in which the technical knowledge to deal with them exists. The I series recommendations will all be new recommendations, except for I.120, [Description of] Integrated Services Digital Networks, which will be the present Recommendation G.705. (A complete list of the proposed I series recommendations is on pages A.211 through A.219.) Following is a list of the titles only of the proposed recommendations. Several working parties, or sub-working-parties, completed drafts of recommendations that may ultimately become part of the ISDN set. Those for which drafts were prepared at this meeting are indicated by a [], following the title, which contains the page number on which the draft text can be found. It will be noticed that in many cases the number on the draft does not correspond to the number in the following list. The reason is that I.110, which contains a list of the standards, was not completed until the end of the meeting, after many of the drafts were completed.

- I.110 General Structure of the I-Series Recommendations [pp. A.212-A.216]
- I.111 Relationship With Other Recommendations Relevant to ISDNs [pp. A.217]
- I.112 Vocabulary (With Annex: Glossary of ISDN Terms) [pp. A.224-A.230]
- I.120 [Description of] Integrated Services Digital Networks [pp. A.218-A.219]
- I.200 [I.200 series specification is not complete, but will cover service capabilities.]
- I.2xx Services Supported by an ISDN [pp. A.168-A.181]
- I.310 ISDN Functional Architectural Model [pp. A.117-A.135]
- I.311 ISDN Protocol Reference Model [pp. A.142-A.157]
- I.312 ISDN Hypothetical Reference Connections
- I.320 ISDN Numbering and Addressing Principles [pp. A.136-A.140]
- I.321 ISDN Routing Principles
- I.3xx Network Connection Types [pp. A.107-A.116]
- I.330 Overall Performance Objectives Relating to Circuits
- I.331 Performance Objectives Relating to Packet Switched Connections
- I.340 [I.340 series specification is not complete, but will cover testing and maintenance.]
- I.350 [I.350 series specification is not complete, but will cover evolution from present networks to ISDNs.]
- I.410 General Aspects and Principles Relating to Recommendations on ISDN User-Network Interfaces (formerly I.XXW)
- I.411 ISDN User-Network Interfaces--Reference Configurations (formerly I.XXX)
- I.412 ISDN User-Network Interfaces--Channel Structures and Access Capabilities (formerly I.XXY)
- I.420 Basic User-Network Interface
- I.421 Primary Rate User-Network Interface
- I.422 C-Channel User-Network Interface
- I.42x [Other channel structures for further study.]
- I.430 General Aspects of Layer 1 Functions and Protocols
- I.431 Basic User/Network Interface--Layer 1 Specifications [pp. A.075-A.090]
- I.432 Primary Rate User-Network Interface--Layer 1 Specifications
- I.433 C-Channel User-Network Interface--Layer 1 Specifications
- I.440 General Aspects of Structure of Layer 2 Functions and Protocols

- I.441 Specification of Layer 2 Protocol
- I.450 General Aspects and Structure of Layer 3 Functions and Protocols
- I.451 Specification of Layer 3 Protocol
- I.460 [Related to maintenance and testing.]
- I.470 General [Support of Existing CCITT Interfaces; e.g. X.25, X.21]
- I.471 Support of Recommendation X.21 and X.21bis DTEs by an ISDN
- I.472 Support of Recommendation X.25 DTEs by an ISDN
- I.473 Support of DTEs Recommended in the V-Series by an ISDN
- I.500 [I.500 series specification is not complete, but will cover internetwork interfaces.]

5. More Detailed Discussion of Major Areas of Work.

5.1. Time Division Multiplexing of the Basic Access Channels.

The specification of the structure of the channels within the basic access rate of 144 kbit/s, as available to the user, has been one of the difficult problems associated with the design of ISDNs. It is desirable, because of the significant shortening of signalling distance when bit rate increases, especially when wire pairs are used, that the total bit rate be kept as low as possible. However, the need for framing bits, dc balance bits, and bits for contention resolution have forced the experts to add about 33 per cent overhead to satisfy these functions.

A major area of discussion from the first has been whether or not parallel connections of terminals would be permitted. Parallel connection of terminals is usually referred to in ISDN papers as the passive bus, since a wiring bus type arrangement with stubs connecting to individual terminals can be envisioned. The USA alone has opposed the passive bus, citing difficulties with stubs on transmission lines and other reasons. Other countries, however, have argued that the usefulness of such arrangements to the customer make provision of such a service essential. There are certain technical and marketing implications to either approach, moreover. If parallel connections are used, which is the way most home and small business telephone extensions are wired at present, the logic to control parallel digital devices must be a part of the central office switch. Digital telephones, however, cannot be used simultaneously for "conference" talking, as can analog telephones. Conferencing must be done either by connections to the digital telephones themselves, or by an auxiliary device on the customer's premises, or by establishing a conference loop back to the central office. Two 64 kbit/s full duplex channels will be available on each basic access line, so one could be used for the loop back.

Without the bus, however, each residence with more than one telephone or terminal would have to have some sort of PABX to which the instruments would be connected. This arrangement is referred to in ISDN discussions as the star configuration. It has the advantage that electrical interaction of the separate terminals does not have to be considered and conferencing facilities could be included. Its disadvantage, besides the cost of the PABX, is that separate wires would have to be run from the PABX to each terminal, even if they were located, for example, on opposite sides of the same wall. Since ISDN connections require four wires, the amount of additional wiring could be appreciable.

At the Kyoto meeting, a framing and contention resolution technique to accommodate parallel connection of terminals was developed and approved. Actually, the technique is also suitable for the star configuration, but it contains more overhead bites than would be needed to support only the star configuration.

The signal on the line is encoded according to a pseudo-ternary-code, as is shown on page A.088. Pseudo-ternary is actually another name for alternate-mark-inversion (AMI) or alternate-space-inversions (ASI) coding, depending on assumed polarity of mark and space. It has the desirable features of a neutral level, which can also be a high impedance state for the transmitter, and of never being more than one bit off dc balance. If a transmitter assumes a high impedance state for the center voltage level, then any other transmitter attempting to transmit at a high or low voltage level will cause the bus to rise to its level.

As can be seen from the figure on page A.089, the time division multiplexing structure is such that a 48-bit frame carries 4 bits from the 16 kbit/s D (signalling and data) channel and 16 bits from each of the two 64 kbit/s B (data) channels. To maintain dc balance, balancing bits (L bits) are inserted after each block that might be from different transmitter in the direction from terminals to network and at the end of the frame in the direction from network to terminals (since there is only one transmitter in that direction). Framing is effected by forcing a violation of the alternate space inversion signal; that is, the balancing bit following the framing bit must be negative and the first space bit in the frame must also be negative, violating the alternating positive-negative sequence for spaces. If no data is being transmitted, there might be no spaces to force the violation except for the so-called auxiliary framing bit, FA, which is reserved for that purpose.

As yet, the electrical characteristics of the transmitters and receivers to operate on the bus have not been specified. It is expected, however, that they will be within one or two factors of the characteristics of modern base-band drivers and receivers fabricated on integrated circuit chips; that is, output voltages, under load, of 1 to 2 volts and receiver sensitivities of about 200 mv. Voltages will be kept as low as possible to control electromagnetic radiation from the leads. (Note: Government telecommunications planners should consider that radiation from ISDN terminals may be more severe than from existing telephones and should determine if shielded leads are warranted. Bus arrangements of multiple terminals requiring shielded connections will usually be more economical than star arrangements.)

5.2 Channel Structure for Higher Bit Rates and For Private Branch Exchanges.

Private branch exchanges (PABXs) may require many more 64 kbit/s data channels than the two in the basic access arrangement. The discussions related to standardizing higher capacity combinations have centered around two major factors: how to make use of subdivision of existing digital transmission rates (e.g., 1544 kbit/s and 2048 kbit/s) and how many signalling channels are needed to control the data channels. Insofar as PABXs are concerned, it has been decided that the 64 kbit/s B (data) channels will be arranged in groups

of either 23 or 30 and the D (signalling) channel will be probably at a rate of 64 kbit/s. (See paragraph 2 on page A.015 and the figure at the bottom of page A.034.) Much discussion has taken place about whether a D channel can control more than one group of B channels. For example, if more than 23 B channels are needed by a PABX, it would be possible to have two 1544 kbit/s streams multiplexed so that 23 B channels and 1 D channel were in one stream and 24 B channels in the other. There is sentiment against such a method, however, because the 1544 kbit/s interface would no longer have a standard structure. For users interested in reliability, such as the Government, separating B data channels from their associated D signalling channel means that if the high rate (say, 1544 kbit/s) stream containing the D channel fails, then all the B channels on both that stream and any others using the same D channel also fail. Paragraph 2.4.2 on page A.016 indicates, however, that such an arrangement might be ultimately approved.

It is possible that no firm recommendations concerning services at bit rates higher than 64 kbit/s will be made this study period (ending in December 1984) because of lack of time. However, the need for such services is recognized. Although a user with basic service will have two 64 kbit/s channels, the relative bit time delays between these switched channels will not be guaranteed from one end to the other of a connection. That is, due to transmission and processor delays, bits in channel B₁ may not bear at the receiving end of a connection exactly the same time relation to bits in channel B₂ that they did at the sending end. The same lack of relative bit timing integrity would apply also to the multiple B data channels from a PABX. There is tentative agreement, however, the higher rate channels will have bit rate equal to $n \times 384$ kbit/s. (It was noted at the meeting that 384 kbit/s is approximately the rate needed to transmit digital stereo music.) There was some attempt to specify n as equal to 2^m , where m is an integer, but no firm consensus could be reached because all such combinations would not be submultiples of rates of common digital transmission systems.

5.3 Numbering Plan.

The numbering plan of ISDNs will have considerable impact on the planning of Government telecommunications systems because the Government has many private networks that must be connected to each other through an ISDN and to other subscribers on the ISDN and because certain numbering plans may be better adapted to restoral plans and mobile subscribers (such as ships and military units) than other plans.

Two requirements in draft Recommendation I.310 (page A.136-A.140) appear to be especially useful in Government and other private networks. One is that the "ISDN number shall be capable of unambiguously identifying a particular mobile interface" (paragraph 5.8 on page A.140). Paragraph 4.6 on page A.138 also mentions the mobile terminal (TE, for terminal equipment).

The other useful requirement is that the signalling system must be able to transfer a user request for selection of a particular on-route network. (See paragraphs 4.1 and 4.5 on page A.138.) This requirement was put in primarily to allow subscribers in, say, Europe, to establish a call to the U.S.A. in their state-owned networks and specify a carrier in the U.S.A. (such as MCI) for the long distance portion of the terminating segment of the call. For

marketing reasons, some countries object to this because it precludes their negotiating with a particular carrier for interconnection. For the Government user, however, it would allow specification of particular routing to make use of Government telecommunications assets or to select the most reliable paths under various situations.

5.4 Delay Between Answer and Switch-Through of B Channel.

The exact time during call setup and answer at which the B channel (which may carry digital voice) is connected through from end-to-end is a matter that has significance to both the user and the network, insofar as charging and billing is concerned. Since the B channel will operate at 64 kbit/s, much information can be transmitted in a fraction of a second. (A message that is 128 octets long could be transmitted in .016 of a second.) The discussion on this topic at the Kyoto meeting is summarized on page A.192 and A.198.

The figure on page A.198 summarizes the various methods that are under consideration for PABX connections, although the same principles apply to non-PABX calls. The more or less horizontal lines in the figure represent signalling messages on the D, signalling channel, while the Xs indicate the points at which the B, data (or digital voice) channel, is connected through.

In cases a) and b), the B channel is not connected through until the call accepted (call answered) signal is received by switch serving the called station. This signal is initiated by the called terminal answering the call. In cases in which the verbal answer may occur almost immediately as the telephone goes off hook, as when a PABX operator wearing a headset answers by pushing a button, the call accepted message may not reach the switch until shortly after the verbal answer arrives. In that case, the first part of the speech would be clipped. (As a practical example, if the operator answered "NCS Technology and Standards Office," the N and perhaps the C and S might not be heard at the other end.)

In case c), the B channel is connected through the network as soon as the connection is made to the called station. Charging does not begin, however, until the called station has answered. Since the B channel has been connected through previously, and since the D channel message may travel slower than bits in the B channel, the first fraction of a second of the B channel data may be transmitted with no charge. If the B channel data is text rather than digital voice, only a fraction of a second may be required, so the called station could disconnect even before the first call accepted signalling message reaches the point in the network at which duration charging begins. In that situation, accurate charging would be difficult.

Annex to TIB-83-1

Report of the Group of ISDN Experts of Study Group XVIII of
the International Telegraph and Telephone Consultative Committee (CCITT)

February 14 - 25, 1983
Kyoto, Japan

[Note: The table of contents, on pages A.002 through A.009, was prepared by NCS, and therefore is not part of the meeting report. The page numbers given in the left column refer to the boldface numbers (added by NCS) preceded by A. at the top of the sheets--not to any other typed or handwritten page numbers that were part of the temporary documents prepared at the meeting. It can be noticed that the meeting report is composed of a number of temporary documents (TDs) that were prepared by various drafting groups. The TD numbers were issued sequentially as the documents were completed and are not necessarily in sequential order in the completed report.]

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C.C.I.T.T.

Temporary Document No.26

STUDY GROUP XVIII

(GROUP of experts on ISDN matters)

Kyoto, 14-25 February 1983

Questions : 1,2,4,5 and 6 / XVIII

SOURCE : CCITT secretariat

TITLE : Report of the meeting of the Group of experts on ISDN
matters of Study Group XVIII (Kyoto, 14- 25 February 1983)
-(1st part)

CONTENTS

- I - General
- II - Report of Working Team 1 (Customer Accesses)
- III - Report of Working Team 2 (Basic Accesses : Level 1
Characteristics)
- IV - Report of Working Team 3 (Network)
- V - Report of Working Team 4 (Services)
- VI - Report of Working Team 5 (Signalling)
- VII - Report of Working Team 6 (Switching)
- VIII - Report of Working Team 7 (Drafting Recs)
- IX - Report of the ad hoc group on ISDN definitions

List of participants

I. 1 - Introduction

The meeting of the group of experts on ISDN matters of Study Group XVIII (Digital Networks), convened by CCITT Collective - letter No. 123 of 4 November 1982, took place at the Kyoto International Conference Hall from 14 to 25 February 1983, thanks to the kind invitation of Nippon Telegraph and Telephone Public Corporation (NTT).

The chairman of Study Group XVIII (Mr. T. Irmer, Federal Republic of Germany), chaired the meeting. In accordance with the decision taken at the last meeting (Geneve, 10-22 June 1982) of Study Group XVIII (see points V. 4 of COM XVIII R9), the meeting has been prepared by a preceding coordination meeting of the Special Rapporteurs for Question I / XVIII, points A, B, C, D and E, 2 / XVIII, 4 / XVIII and 5 / XVIII, the vice-chairmen of Study Group XVIII and the CCITT Secretariat, which took place also in Kyoto on 10-11 February 1983 under the chairmanship of Mr. H.K. Pfyffer (Switzerland), Vice chairman of Study Group XVIII. The coordination meeting has revised the agenda for the group of experts meeting as shown in Annex 1. In parallel with the meeting of the Group of experts on ISDN matters, there has been also a meeting of the ad hoc group on ISDN definitions (Question 6/XVIII) under the chairmanship of Mr. P.G. Clarke, British Telecom-United Kingdom.

Annex 2 gives the list of delayed contributions considered at the meeting. The list of participants is given at the end of this report.

I. 2 - Opening session

Mr. T. Irmer, chairman of Study Group XVIII, in his opening address, thanked, in behalf of all delegates, NTT for hosting the meeting of the group of experts on ISDN matters and for all the facilities provided. Mr. Irmer recalled also a previous meeting held in Kyoto in 1975 by Special Study Group D and the amount of technological progresses that have been developed since then, as well as the further steps achieved in setting corresponding international Recommendations.

Dr. Y. Kitahara, Executive Vice President of NTT in the welcoming address pointed out the interest of having in 1983, stated by United Nations as the world telecommunication year, the meeting of the group of experts on ISDN matters of Study Group XVIII hosted

in Kyoto. In wishing a fruitful work to the participants, Dr. Kitahara, outlined the important achievements in the following fields:

- digital technology, allowing a possible cut of costs of switching and transmission by nearly half.
 - optical fiber telecommunication technology, allowing an overall reduction in the cost of transmission paths
 - large-capacity satellite communications technology, that could be a potent force in the way to eliminate the difference in rates resulting from distances both within countries and between them.
 - new generation of computers with intelligence to form INS (Information Network System) in which information processing and telecommunications are highly integrated.
- Finally, Dr. Kitahara, stated his confidence that the expert's meeting will be an extremely successful and that it will stand out in the annals of the CCITT as an epoch-making step on the way toward the creation of future telecommunication networks.

I.3 - Organization of Network

Annex 1 gives the agreed agenda for the meeting of the group of experts on ISDN matters of Study Group XVIII. In addition to the ad hoc group on ISDN definitions, the meeting decided to set up the following Working Teams

- WT 1) - Customer Accesses (Question 2/XVIII) - Chairman:
Mr. W. S. Gifford, ATT-United States of America
- WT 2) - Basic Accesses (Question 1/XVIII, point C) - Chairman:
Mr. U. De Julio, SIP-Italy
- WT 3) - Network (Question 1/XVIII, points B and E) - Chairman:
Mr. J. C. Luetchford, BNR- Canada
- WT 4) - Services (Question 1/XVIII, Points A and D) - Chairman:
Mr. P. Kahl, Federal Republic of Germany
- WT 5) - Signalling (Question 4/XVIII) - Chairman Mr. B.W. Moore,
British Telecom - United Kingdom
- WT 6) - Switching (Question 5/XVIII) - Chairman: Mr. S. Kano, NTT-Japan
- WT 7) - Drafting on Recs. G.705, Ixxw, I.0010, I.0020 and I. 0030
Chairman: Mr. H.K. Pfyffer, Switzerland

The report of these Working Teams, as amended at the plenary session, is given in Part II to VIII of this Report. It should be mentioned that Working Teams 3 and 4 have based their work on the agreement reached at a joint meeting chaired by Mr. H.K. Pfyffer (Switzerland) held on 15 February 1983.

The report of the ad hoc group on ISDN definitions is given in Part IX.

I.4. Approval of previous reports

I.4.1. The meeting approved the report of the meeting of experts on level 1 characteristics of the basic ISDN user/network interface (see COM XVIII-R14). This report of the Florence meeting (8-12 November 1982) has been considered as reference material to be further discussed at the present meeting.

~~The representative of the United States of America, while agreeing with this approach, made some reservation, pointing out that other technical solution than those given in COM XVIII-R14 could be explored.~~

~~The meeting took note of this declaration.~~

I.4.2. It was agreed that COM XVIII No. 132 (Report of the drafting group on ISDN Recs, Geneva, 18-20 October 1982) could be considered as basis for further considerations by the present meeting. This document already responds to the request advanced by some Administrations at the June 1982 meeting (see point II.2 of COM XVIII-R9)

The representative of France pointed out the need to further modify Recommendation G.705 in order to reflect the latest technical work. It was agreed that the French proposal (see delayed contribution IB) will be examined by Working Team 7.

I.4.3. The meeting examined also the proposal of establishing the I-series of Recommendations (see COM XVIII-No.134) made by the drafting group on the structure of the ISDN Recommendations, which met also in Geneva on 20-21 October 1982 under the chairmanship of Mr.H.K.Pfyffer (Switzerland).
(remaining text to be drafted after Friday plenary)

I.5. Miscellaneous

I.5.1 In considering Temporary Document No.10 (CCIR Study Group 4) and delayed contributions IX (COMSAT) and JD (KDD), the meeting agreed that the aspects of performance issues (in particular BER, delays, etc.) on hypothetical Reference Connections and in hypothetical reference digital paths should be studied in the framework of question 9/XVIII. Working Team 3 will consider only the aspect of these contributions dealing with network modelling.

I.5.2 The liaison officer of Study Group VII (Mr.E.Scace-GTE-United States of America) gave in Temporary document No.19 a report on the recent Study Group VII activities.

I.5.3 The reports quoted in COM XVIII - nos 127 and 128 (secretariat) have been superseded by temporary documents presented at this meeting reporting on recent meetings of Study Group VII and XI.

CCITT
S.G. XVIII
(GROUP OF EXPERTS ON ISDN MATTERS)

TEMPORARY DOCUMENT NO. 49

Kyoto 14-25 February 1983

Source: Chairman of Working Team 1 -- User Access

Title: Report of Working Team 1 -- User Access

1. The group agreed that the terms of reference were to refine the specification of user access interfaces and arrangements leading to the preparation of draft recommendations, in particular I.1020 and I.1030. An agenda was accepted and delayed documents were allocated to the topics; this agenda and allocation are shown in Annex 1. Documents from the other Study Groups were reviewed and relevant questions identified; these are listed in Annex 2.

2. Primary Rate Multiplexed Access

Delayed documents were presented and considerable discussion followed, as summarized in Annex 3. The group reached the following conclusions and areas for further study:

2.1. The channel structure currently shown in draft Rec. I.XXY for $24B + D(4\text{kbit/s})$ will be deleted. One administration suggested that it might be appropriate to keep $24B+D$ (the rate of D is for further study) to provide commonality with the high speed channel structure as described in section 3.

2.2. Signalling for a given B channel would not be provided by more than one D channel. No load sharing or automated load transfer would be provided for in this plenary period. This does not preclude manual restoration arrangements or semiautomatic procedures in the case of failures of a D channel. When additional capacity may be required for packet switched data B channel should be used rather than requiring additional D channels.

2.3. Working team 5 will investigate the impacts of serving more than 23 or 30 B channels with one D channel, corresponding to the two different primary rates.

2.4. Depending on the outcome of the Working Team 5 analysis, and the interrelations with future possibilities for signaling for channels at less than 64 kbit/s which might be carried together in a single B channel, as described in section 7, further study is needed on the possibility of a D channel carrying signaling for the B channels in other primary rate multiplexed interfaces. The following conclusions and areas for further study were identified:

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2.4.1. The channel structures $23B + D$ and $30B + D$ will continue to be the principal primary rate multiplex channel structures.

2.4.2. If a D channel can carry signaling for a B channel in another primary rate interface, then the D channel in the second primary rate interface might not be active (this is for further study).

2.4.3. For the 1544 kbit/s primary rate, a channel structure of $24B$ is for further study. This would be used in conjunction with a $23B + D$ channel structure to provide a total access capability of the form $(23 + 24n)B + D$, with $n = 0, 1, 2, \dots$, to be determined.

2.4.4. For the 2048 kbit/s primary rate, a channel structure of $30B$ is for further study. The use of $31B$ was considered to be of interest, but further study is required as it may have some problems. Thus access capabilities of the form $(30n)B + D$ are for further study, $n = 2, 3$, or 4 .

2.4.5. Secondary rate channel structures are for further study and may be a way to approach these cases.

2.5 None of these topics on sharing of signaling for more than one primary rate multiplex access was considered to be of high priority in this plenary period.

2.6. The need for multiplexing of several basic accesses onto a single primary rate access, e.g., $n(2B + D)$ was proposed but was considered to be an internal network matter for the use of transmission facilities at this time. This may have some impact on the exchange, which will be considered in working teams 5 and 6. A diagram illustrating the difference between access interfaces and internal network arrangements was discussed, and is included as Annex 4. This diagram also covers the case of several groups of channels on a single primary rate access interface. Thus the proposals for channel structures of the form $(n_1B + D) + (n_2B + D) + \dots$ are for further study, for internal network interfaces.

2.7. In a primary rate multiplexed access, the D and B channels are point-to-point at level 1, rather than being used in, for example, a passive bus arrangement.

3. High Speed Channels and Channel Structures

There was considerable discussion of high speed channels, H, using a primary rate access interface. While no firm agreement was reached at this time on any specific arrangements, it was decided to propose a high speed channel framework and channel structure for consideration by other Study Groups and to request inputs for the Study Group XVIII meeting in June so that progress can be made at that meeting. The framework, proposed by NTT, is:

{Some [Italy & Germany] expressed interest for up to 1,920 kbit/s video conferencing}

High speed channel's, H, which are based on multiples of 384 kbit/s ($=6 \times 64$): $H = 384n$, where values of $n = 1, 2, \dots$ are for further study. This framework would aid in providing compatibility between 1544 and 2048 kbit/s system. Annex 5 contains a description of the proposed framework for distribution to other Study Groups. Some of the alternatives for consideration are described below:

3.1. The USA proposed that the values of n be selected as powers of 2, up to 2, leading to $H = 384n$, $n = 1, 2, 4$, for speeds of 384, 768 and 1536. This would permit compatibility of service by permitting channels to be routed in either 1544 or 2048 kbit/s systems. Thus the USA felt this should be given strong consideration as part of the worldwide standardization on ISDN.

3.2. ~~The FRG proposed that the basis for high speed channels should be 192 kbit/s ($=3 \times 64$). Thus the high speed channels would be $192n$, $n = 2, 3, \dots$, for further study.~~

3.3. The High Speed Channel Structure proposed by NTT is $H + D$. The speed of the D channel is for further study, with 4, 16 and 64 kbit/s being candidates. The USA and Canada expressed strong concerns about the aspect of the NTT proposal which involved a channel structure in excess of the current 1544 kbit/s primary rate access, viz., $1536 + D$ at 16 or 64 kbit/s. ~~A channel structure of $H + D$ is an alternative.~~

3.4. British Telecom expressed an interest in providing an unstructured access capability on the 2048 primary rate interface, which would provide for 1920, 1984, or 2048 kbit/s channels. There was no agreement that this capability should be included. Several objections were raised, including the need for common monitoring, testing and repair capabilities, which would require a common frame format across all channel structures at the primary rate, as proposed by FRG.

3.5. It was noted that CMTT ^{→ 2,448} is considering standardizing the encoding of stereo sound at 260 kbit/s which would not be compatible with the NTT proposal. Thus CMTT, other Study Groups and Administrations will be requested to input to the determination of the structure for high speed channels.

3.6. There was considerable debate over the inclusion of an E channel, based on CCITT Signaling System No. 7, for use in primary rate access in place of the D channel. The following restrictions were proposed as a basis for agreement:

3.6.1. The call control procedures of the E channel must be compatible with the level 3 protocol of the D channel.

3.6.2. The E channel would be listed as an alternate arrangement applying only to multiple primary rate access installations, and even there the D channel is the preferred approach. The E channel approach is favored by those who view PABX's or other large installations as functionally similar to a local exchange from the point of view of traffic and security needs.

move to section 2.

4. Intermediate Rate Access

A variety of approaches was discussed, leading to the following conclusions:

4.1. Use of the primary rate access interface was strongly favored, using reduced access capability instead of a new channel structure or a new physical interface.

4.2. No new channel structures or interfaces are envisioned at this time (although the French PTT proposed a new channel structure of $9B + D$ to correspond to their proposed transmission system at 704 kbit/s).

4.3. The relationship of intermediate access to wideband channel structures, as described below, must also be considered.

5. Basic Access

The proposal by IBM Europe was not viewed as being sufficiently documented with cost or other advantages to warrant making a change at this late stage in the specification of this important characteristic of ISDN. Much work has already been based on the decision reached a year ago to proceed with $2B + D$; for example, the physical interface specification is already well advanced and would be significantly affected by this change.

6. Hybrid Access

The ability to provide an analogue channel, A, together with the basic access, having capabilities of $D, B + D$, or $2B + D$, was strongly supported. Several areas for further study, and confirmation were identified, as follows:

6.1. Working teams 5 and 6, along with Study Group XI should consider whether the D channel can provide some or all of the signaling for the associated analogue channel, and how it can be implemented. This is viewed as an important characteristic, especially in the early stages of the ISDN, and should be studied.

6.2. The specification and definition of the D channel need to be reviewed to assure that the access capability $D (+ A)$ can be accommodated, because in this case there may be none, some or all of the signaling for the A channel in the D channel, and there is no B channel to be signaled for.

6.3. While most delegates noted the desirability of using the D channel in place of a C channel in hybrid access, the existence of the above questions indicates that the C channel should not be deleted at this time from draft Rec. I.XXY.

6.4. The C channel approach should be as similar as possible in protocol and other characteristics to the D channel.

7. Channels at less than 64 kbit/s

A discussion of channels at less than 64 kbit/s in the ISDN led to the following conclusions:

7.1. It was reconfirmed that 8, 16, and 32 kbit/s are the channel speeds which will be recognized by the ISDN; thus an ISDN will not be required to recognize any other speeds below 64 kbit/s. It was reconfirmed that circuit switching within the ISDN will be at 64 kbit/s.

7.2. It was agreed that octet alignment would not be provided for these channels at 8, 16, and 32 kbit/s. This conclusion was based on the analysis by NTT that voice and data services do not require this feature. Also severe problems were identified in attempting to plan how such a capability would be provided by the ISDN.

7.3. The user may multiplex several signals together in the same B channel but for the 1984 Recommendations an entire B channel. Leased services which can route these subrate channels to different locations, even though they enter the network in a single 64 kbit/s channel, have been proposed.

7.4. It is important to standardize the mechanism for multiplexing these channels together so that user equipment can be compatible with leased services and with the future possibility of providing switched services at these speeds in the ISDN.

7.5. ~~The ISO proposal to adapt terminals that provide an interface conforming with CCITT Recs V.24, V.25, V.28 and V.35 is accepted. It was also agreed that terminals which use preferred rates in Rec. V.6, 19.2 kbit/s and 56 kbit/s, in addition to those in Rec. X.1 should be supported through rate adaption.~~ *For example,*

7.6. The need for adapting information stream at these rates to the ISDN rates of 8 or 16 or 32 kbit/s (stage 1) is identified to Study Group VII.

7.7. The two-stage method of rate adaption as indicated in COM XVIII No. R8 was reaffirmed. It was noted that Study Group VII has proposed a rate adaption approach which may not be compatible with the multiplexing of several 8, 16, or 32 kbit/s channels into the same 64 kbit/s channel, *gives that octet timing is not available for the*

7.8. While separate meeting of different information streams in the same B channel is not presently required for circuit switches services, Study Group XI should consider this possible future application in designing the addressing and other capabilities of the signalling procedures.

6.4. The C channel approach should be as similar as possible in protocol and other characteristics to the D channel.

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given that octet timing is not available for the

8. Relationships of User Information Streams, Channels, Access Capabilities, Channel Structures, and Access Interfaces

The concepts of channels, channel structures, access capabilities and access interfaces were reconfirmed. A method for representing the inter-relationships of these concepts, including rate adaption and multiplexing was developed and is included as Annex 7.

9. Functional Groupings

Minor changes in the wording of the draft recommendation I.XXX was adopted for the NT1. It was agreed that this is not the appropriate place to refine the specific functions in the NT1; this will take place in Working Team 2, as no change in basic principles was proposed.

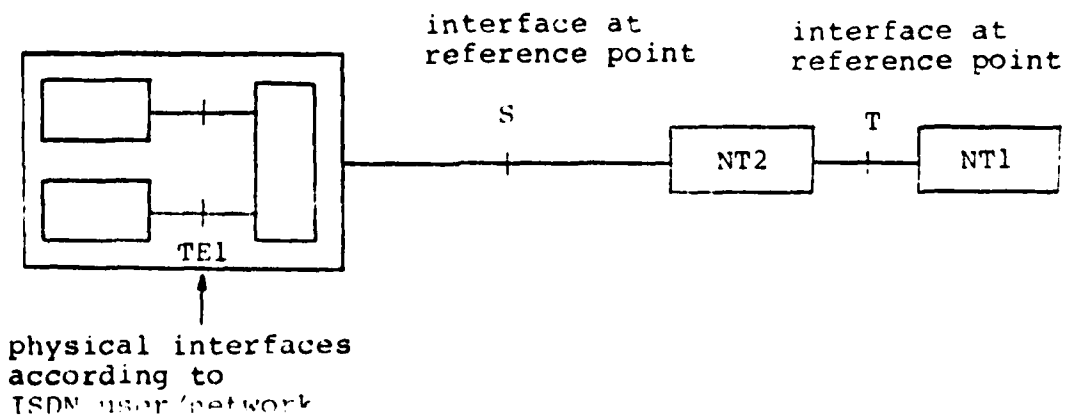
10. Reference Configurations

Several issues were raised dealing with reference points and addressability. Final conclusions must await the results of Working Team 3 on Network addressing. Tentative results are as follows:

10.1. In general the S reference point is used to represent the smallest individually addressable unit of the ISDN, within the numbering plan (note this does not include logical addresses in packet headers, or logical or equipment addresses associated with service indication and/or negotiation such as takes place on a bus with multiple terminals.). For more information see draft Recommendation I.310.

10.2. (To be supplied)

10.3. It had been proposed in COM XVIII 132 R.2 that an additional diagram be added showing two S-reference points in tandem. Following further discussion it was agreed that in accordance with the concepts embodied in the reference point and functional grouping approach such as addition could not be made. The understanding is that two reference points could not exist in tandem but this does not include the case that within a distributed TEL arrangement the standard ISDN user/network interface may be used.



10.4 Study Group VII questioned whether multipoint B channels were allowed at reference points S and T. While the term channel is defined to be point-to-point, it was viewed that broadcast ~~and~~ other arrangements could be provided either as ISDN services or through user equipment. Definition of the appropriate services will be considered in Working Team 4. These physical arrangements should work within the defined characteristics of the interfaces, and not be used to define new requirements for the electrical and other characteristics at the interface.

11. Draft Recommendation I.XXX

Editorial changes were made in draft Recommendation I.XXX. These are listed in Annex 9.

12. Draft Recommendation I.XXY

12.1. Changes were made to draft Recommendation I.XXY to reflect the agreements described above on:

12.1.1. New speeds for rate adaption

12.1.2. Requirements for the D channel to accomodate the hybrid access arrangement.

12.1.3. Definition of the D channel, channel structure and its use.

12.2. Editorial changes were also made. All of the changes are listed in Annex 10.

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ANNEX 1**Delayed Contributions in Order of Agenda Presentation****- Primary Rate Multiplexed Access**

JN	JK
GY	KR
HS	KQ
HX	KX
HW	(HT)

- Intermediate Rate Access

HT	HW
HX	GX
IF	(IE)

- Other Primary Rate Accesses

GX
GY
(HT)

- Basic Access

IU	KL
KD	KD
JU	KU
KK	(IV)

- Hybrid Access

IU	KL
JU	KK
KJ	

- Channels Less Than 64 kb/s

GZ	HP
HL	(JE)

**- Relationship of User Information Streams
Channels, Access Capabilities, Interfaces**

(JC)

LC - not discussed

- Functional Groupings (NT 1)

IZ
KU

- Reference Configurations

HC	(II)
HZ	(JN)
KU	

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ANNEX 2

Questions from Other Study Groups

Study Group VII (see T.D. 19)

1. Can Multiple TE2's be supported a single TA?

Response : see paragraph 10.2 of the report and Annex 8.

2. Is multipoint operation contemplated with a D channel at 64 kbit/s?

Response : Not at level 1, but possibly at level 2, see paragraph 3.6 of the report

3. Should multipoint B channels be allowed at reference points S and T?

Response : See paragraph 10.5 of the report; other parts of section 10 are also relevant.

4. Will ISDN provide bearer rates at less than 64 kbit/s?

Response : Yes, at 8, 16 and 32 kbit/s although these will not be individually switched, at least initially if they are multiplexed in the same 64 kbit/s channel; see section 7.

5. Study Group VII's attention is especially drawn to paragraphs 7.5, 7.6 and 7.7 of the report, along with Annex 6.

Study Group XI (See TD1, 2 and 9)

1. Should channels at speeds lower than 64 kbit/s be taken into consideration?

Response : Yes, see section 7.

2. Should wideband channels be taken into account?

Response : See section 3 and Annex 5.

3. Should multipoint B channels be considered?

Response : See section 10.

4. Is point-to-multipoint operation envisioned for D channels at 64 kb/s?

Response : Not at level 1, but possibly at level 2, see paragraph 3, 6 of the report.

5. What is the relationship of D and E channels?

Response : See paragraph 3, 6 and the proposed revisions to draft Recommendation (I. XXY) in Annex 10.

Consideration Of The Primary Rate Multiplexed Access

The FRG proposed in Delayed Contribution GY a common basic frame structure at 2048 kb/s for both multiplexed and broadband access, viz., frame length 256 bits and frame alignment signal per Rec. G 732, the use of a terminal adapter is also supported where needed to relate to an ISDN interface.

In Delayed Contribution HS, NTT proposed that a PBX is assumed to terminate at least layer 1, 2 and 3 protocols and should be limited to a point to point configuration at the T interface. In addition D and E channels should be associated only with B channels appearing in the same channel structure.

NTT presented a new text for Draft Recommendation (I.XXY), for channels having capacity above 64 kb/s in Delay Contribution HW. A "H-channel" of 384 kb/s with $n=1, 2, \dots$ is defined to carry a wide variety of user information streams. Signalling information would be carried over a D channel in each case, e.g.

384 + D,

768 + D,

1536 + D,

1920 + D in a high speed channel structure or a

multiplexed channel structure with commonality in frame structure. D channel capacities are discussed in Delayed Contribution HX to cover 4, 16 and 64 kb/s with further study suggested for the most economic implementations, additional possible composite structures and subdivisions of the B channel.

TCTS (Canada) presented Del. Contr. JK indicated no support for a 4kb/s D channel capacity in its presentation for an MB + ND primary rate channel structure with $N=1$ to 5 as required and $D=64$, AT&T proposed a channel structure of $pB + qD$ which allows the flexibility of any number of B channels to be supported by a single D channel in its Delayed Contribution KR. The U.S.A. Delayed Contribution KX was also presented to support a single protocol for primary access to embrace both PBX and non-PBX applications. Comments on the latter were made to reflect the point that Study Group XI is moving toward two solutions to satisfy two sets of requirements.

BT pointed out that "H channels" could not be agreed upon in this plenary period and that we should concentrate on what is relevant in this plenary period. The discussion that followed concluded that load sharing of signalling information among more than one D channel with load transfer capabilities was not supported at this time. Further discussion focused on the primary channel structure. There were arguments for a specific channel structure such as noted in Munich for 1544 kb/s and 2048 kb/s, viz. $30B + D$ and $23B + D$ as well as support for flexibility to use one D to serve an entire PBX. It was noted that although Study Group XI was assuming one D channel in each primary access there was no inherent limitation on the D channel to require this, the use of more than one D channel was discussed for possible use to carry packetized data but this generated comments which suggested that such information belonged on a B channel.

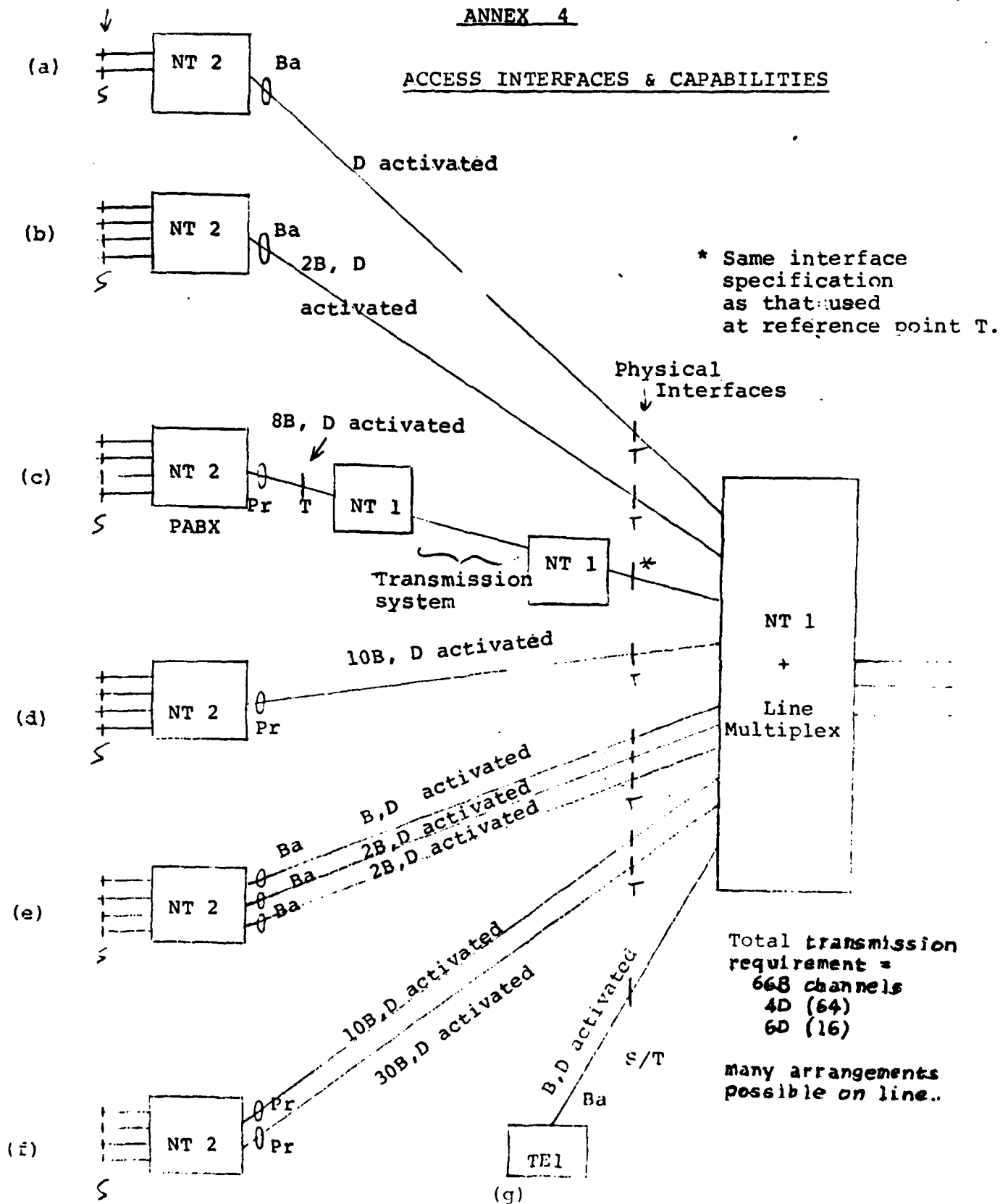
ANNEX 3-2

Channel structure debate produced a summary from BT attached with further study in the next plenary period of other issues such as the multiplexing of a group of 2B + D inputs at NT2 into a primary rate through a T reference point involving levels 2 and 3 functions to combine D channels into a single D in the primary rate multiplexed access.

The conclusions of 15 February were confirmed. It was decided to examine the capability of a D channel to support the signalling needs of at least 125 B channels with the view that a higher limit would be indicated if it applied. NTT called for review of wideband structure while we continue support for 23B + D and 30B + D for multiplexing. FRG noted the need for future study of the signalling support for 24B and 31B by the D channel in a basic 2B + D access. Canada and IBM Europe disagreed over whether 24B should be acknowledged as a channel structure now with signalling support in a parallel 23B + D. BT made the point that there is nothing to preclude utilization of all channels in the transmission line itself if you support more than 23 or 30B channels with one D and do not activate one or more D channels. The point made is that we can utilize the capacity immediately without necessarily validating a 24B or 31B channel structure at this time if we confirm that no adverse signalling effects result.

The question of E channels to the user premises was debated. E channels are those signalling channels of 64 kb/s associated with Signalling System No. 7. Some administrations wished to support the use of E channels although there was considerable sentiment for support of D channels only. It was noted that it may be desirable to equip some large PABXs with E channels to serve very large numbers of B channels when the System 7 capabilities can be justified. The conflict on this issue would be reduced if the network call control procedure for the E channel and the level 3 protocols of D channel were made compatible. Assuming that is accomplished it would still be necessary to provide guidance as to when System 7 (E channel) should be considered and channel structures to include E would require validation. A draft text was prepared by BT and it was agreed that it was a beginning that required rearrangement and revision to reflect the above. Sweden also proposed change in the text to reflect its desire to use E channels whenever the System 7 features were considered appropriate. The conflict over E channels has manifested itself in Study Group XI as well beginning with a view on the part of some administrations of the utility of System 7 to serve IDN PABXs. Study Group's XI aim is to provide for a common layer 3, but XVIII should perhaps indicate this to be a fundamental requirement in view of the strong views supporting the D channel as the more universal solution.

It was agreed that the primary rate multiplexed access at the T reference point is only a point-to-point configuration at this time but that high speed access must be considered further.

ANNEX 4ACCESS INTERFACES & CAPABILITIES

Ba = Basic channel structure 2B + D (16)

Pr = Primary channel structure 30B + D (64)
or

Annex 5A Framework for Highspeed Channel Types and Channel Structures1. H-channels

1.1. An H-channel is $n \times 384$ kbit/s channel ($n=1, 2, \dots$). An H-channel is intended to carry a wide variety of user information streams, whose bit rate is larger than a B-channel. A distinguishing characteristic is that an H-channel does not carry signalling information for circuit switching of the H-channel's by the ISDN. Signalling information used for circuit switching by the ISDN is carried over other types of channels, e.g., D-channel.

NOTE: The choice of n is for further study.

1.2. User information streams may be carried on an H-channel on a dedicated, alternate (within one call or as separate calls), or simultaneous basis, consistent with the H-channel bit rate. The following are examples of user information streams:

- i) encoded video utilizing linear coding (e.g. at 80 - 90 Mbit/s), intra-frame coding (e.g. at 32 Mbit/s, 34 Mbit/s and 44 Mbit/s), inter-frame coding (e.g. at 1.536 Mbit/s, 1.920 Mbit/s, 6.144 Mbit/s).
- ii) data information corresponding to circuit user classes of service at bit rates larger than 64 kbit/s, which will be standardized by CCITT in the near future.
- iii) wideband voice, or sound program encoded at 384 kbit/s, or other standardized bit rates, and
- iv) digital high speed facsimile at 768 kbit/s, or
- v) combinations of digital information streams carried toward the same destination.

It is recognized that an H-channel may also be used to carry user information streams not covered by CCITT recommendations.

2. Highspeed channel structures

2.1 The highspeed channel structure is composed of One H-channel and one D-channel, $H + D$. The bit rate in this channel structure equals to that of the corresponding multiplex channel structure. The bit rate of the D-channel in this channel structure is X kbit/s. The value of X is for further study.

Note: at least two RPOAS have expressed strong reservations over any solutions where $H + D$ cannot fit within a primary rate access interface (e.g. H at 1536 kbit/s and D at 16 or 64 kbit/s exceeds 1544 kbit/s).

2.2 With the high speed channels structure, one H-channel and one D-channel are always present at the ISDN user/network physical interface. The high speed access capability is $H + D$.

ANNEX 6

Interrelationships of 8, 16 and 32 kbit/s channel multiplexing, 64 octet alignment and rate adaption.

The ISDN is currently being planned to provide octet alignment for 64 kbit/s B channels and related services. Two additional requests have been made which relate to this alignment and its use: octet alignment for 8, 16 and 32 kbit/s channels, and multiplexing of these channels together into the same 64 kbit/s channel. These two capabilities are mutually exclusive unless some additional information were provided by the ISDN.

Octet alignment at 64 kbit/s can be used to provide identification of multiplexed channels, by identifying which bits in each octet are used for which channel. (For example, a 32 kbit/s channel can be formed by using bits, 1, 3, 5, and 7 while a second 32 kbit/s channel can be formed using bits 2, 4, 6 and 8). This capability for multiplexing channels together is viewed as very important for the future of ISDN due to the rapid progress being made in voice coding at 32 kbit/s and lower.

Octet alignment for the 8, 16 and 32 kbit/s channels can be derived from the octet timing on the 64 kbit/s channel, for example, by sending 8 bits of data at a time, corresponding to the octet at 64 kbit/s and then repeating that pattern of bits 8, 4, or 2 times, respectively, to achieve the desired subrate. This repetition introduces delays by requiring that 8 bits of the subrate channel be received before any can be transmitted (actually somewhat less than 8 will be satisfactory because transmission can proceed in parallel with receipt).

Unfortunately, the octet alignment at 64 kbit/s cannot be used for both applications simultaneously. Thus a choice is required: either octet timing or multiplexing of the subrate channels must be unavailable, or some other mechanism must be found to provide both capabilities simultaneously.

Looking first to the need for multiplexing, the rapid growth of low bit rate voice which is anticipated makes multiplexing of subrates essential to ISDN. Looking to the need for octet alignment of the subrate channels, low bit rate voice encoders do not require octet alignment and most data applications, particularly modern ones, either are insensitive to octet alignment or provide for any needed alignment within the information stream, such as the use of HDLC flags (see Delayed Contribution HP from NTT for a more detailed analysis of these needs). The conclusion is that multiplexing is essential while octet alignment for subrate channels might be useful but is not essential.

The next issue is what are the cost and other implications of finding another mechanism within the ISDN for providing both simultaneously. Two basic approaches exist: use bits within the channel to provide this added function or find a new mechanism outside the channel. The former approach can be implemented either by the network or by the user's equipment, with a reduction in the net information rate in either case; user equipment corresponds to ISDN not provided octet alignment,

ANNEX 6-2

and so is not considered further here; use of network equipment for this purpose is not consistent with the basic philosophy of ISDN providing transparent channels and in any case is not compatible with present plans for low bit rate voice encoding, and thus will also not be considered further here.

This leaves the option of finding another signal in ISDN to perform this function. Approaches such as super-frame alignment, that is identifying several octets of the 64 kbit/s channel as a unit, are the most attractive. This approach would work for interfaces or for point-to-point transmission systems with no intervening equipment, but this is not sufficient. Unfortunately, there does not appear to be a satisfactory solution for maintaining super-frame alignment going through circuit switches or even many transmission devices, without introducing considerable complexity, cost and unacceptable delays (at least for voice communications). Other viable alternatives have not been identified at this time.

The conclusion of this analysis is that octet alignment cannot be provided for 8, 16, and 32 kbit/s channels in the ISDN. Next the implications of this conclusion on the multiplexing and rate adaption process will be analyzed.

Given that only octet alignment at 64 kbit/s is available, multiplexing of subrate channels must be accomplished within a single 64 kbit/s octet. Figure 1 shows how this rate adaption and multiplexing can be accomplished with only the octet alignment information for the 64 kbit/s channel. This approach leads to a unique relation between subrate channels (taken as an ordered set for multiplexing) and the 64 kbit/s stream. This approach also has the advantage of not imposing any delay on the transmission of information passing through this process (i.e., bits arriving at the subrate do not have to be buffered waiting for a full octet or other grouping). Additional advantages include being only a level 1 operation, and not requiring buffering in the network, nor the recognition of complex signals generated by users or other equipment. This process can also be implemented in stages, with channels being combined in distributed equipments and yet still resulting in the same bit multiplexed arrangement.

The method so far identified, i.e. the bit repetition method (from 8, 16, 32 kb/s T. 64 kb/s channel), should be applied to the rate adaptation for voice and data application, since both applications will employ the multiplexing capability for 8, 16 and 32 kbit/s channels provided by ISDN in the future. Therefore, SGVII is requested to reconsider the rate adaptation method at step 2 contained in COMVII - R15 and adopt the above method. Furthermore, it is the SGXVIII opinion that SGVII is responsible for rate adaptation method at step 1, but step 2 rate adaptation method should be recommended by SGXIII in order to assure common solutions for both voice and data application.

ANNEX 6-3

Examples of Rate Adaption and Multiplexing

<u>Subchannel Rate (kbit/s)</u>	<u>Subchannel Information</u>	<u>Representation at 64 kbit/s</u>
1. 32	01 01 01 ... →	[0 0 1 1 0 0 1 1 0 0 1 1 ...]
2. 16	01 0 ... →	[0 0 0 0 1 1 1 1 0 0 0 0 ...]
3. 8	01 ... →	[0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1]
4. 32	a b c d e ...	[a m b n c o d p e q ...]
32	m n o p q ...	
5. 16	a b c ...	[a a m m b b n n c c o o ...]
16	m n o ...	
6. 16	a b c ...	[a t m u b v n w c x o y ...]
16	m n o ...	
32	t u v w x y ...	
7. 64 (2 x 16)	a a m m b b n n c c o o ...	[a t m u b v n w c x o y ...]
32	t u v w x y ...	

→ implies multiplexing with the upper signal
 / being taken first.

Note that cases 5 followed by 7 yield the same *result as case 6*.

ANNEX 7

A.033

RELATIONSHIP AMONG USER INFORMATION STREAMS, CHANNELS, CHANNEL STRUCTURES, ACCESS CAPABILITIES AND ACCESS INTERFACES

1. Introduction

This document describes the relationships among user informations streams (that is the information originating from a user terminal or other source) and ISDN channels, access capabilities, and access interfaces.

2. Definitions

A line connecting two entities, represents the insertion of the entity on the left into the entity on the right. Where these entities are equivalent (for example an information stream and a channel that have the same rate) alternative connections are represented by an "or". Where some combination is required "and" is used, for example, channels combined into an access capability.

R/A is used to represent rate adaption which transforms a user information stream at one rate into a stream at a higher rate according to Recommendations in preparation by Study Group VII.

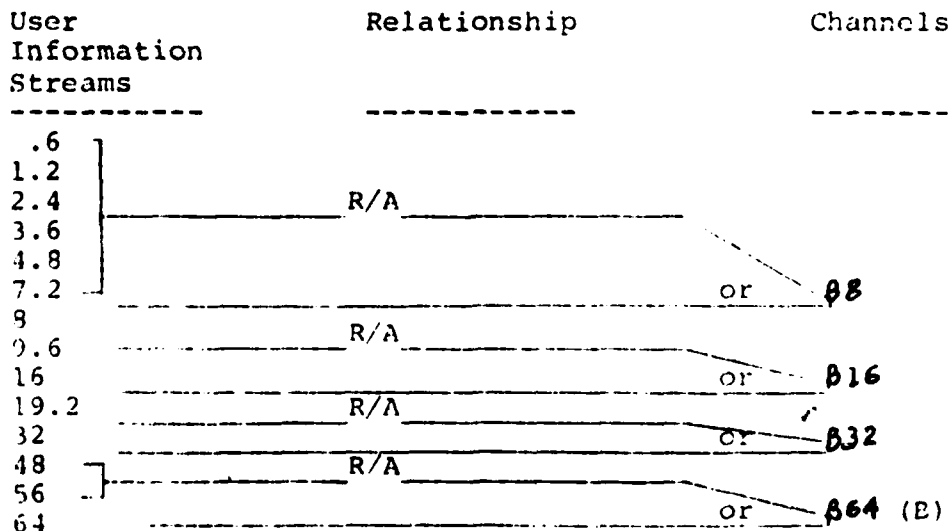
PAD represents a packet assembly/disassembly function which transforms a non-packetized user information stream into a packetized stream at a higher rate.

The temporary term β is used to represent a "channel" which has not yet received an approved name; for example, $\beta 32$ is a 32 kbit/s "channel".

D is a D channel with a rate indicated by the number shown; for example, D16 is a D channel at 16 kbit/s.

Where some number of channels are to be combined and they have the same rate, this is indicated with an "X" and a number corresponding to the number of channels to be combined; for example, ----X3---- represents 3 channels (or streams) being combined.

3. Relationships

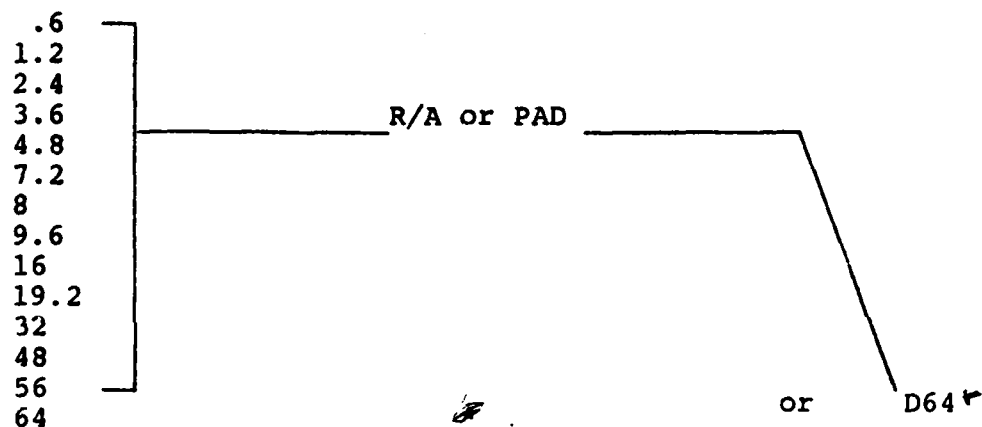
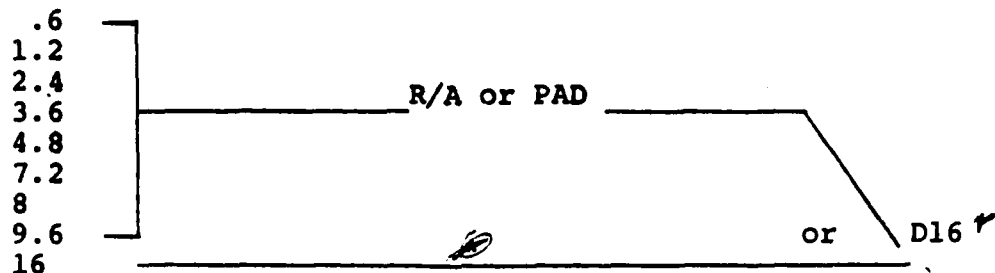


ANNEX 7-2

User
Information
Streams

Relationship

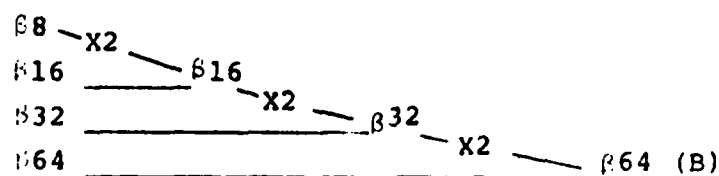
Channels



For Packet Mode Services

Channels

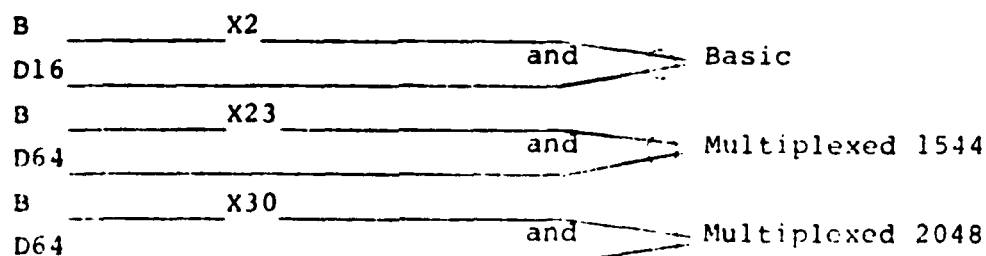
Relationships



Channels

Relationships

Channel Structures



* Assuming the user information stream is compatible with the D channel protocol.

ANNEX 8

A.035

(to be supplied later)

ANNEX 9

Proposed Revisions to Draft Recommendation (I.XXX), see COM XVIII
No. 132-E

[...] = delete ... = insert

2.2. second sentence : In a particular access arrangement, specific functions in a functional grouping may or may not be present.
Note specific functions in a functional grouping may be performed in one or more pieces of equipment. [or they may not be present at all.]

3.2. last sentence becomes Note 1 as follows:

Note 1 : [Also] Physical interfaces not included in CCITT Recommendations [recommended by CCITT] may appear at reference point R.

3.2. Note becomes : Note 2:

3.4. last sentence : For a particular access arrangement, specific functions in a functional group [are either present or absent] may or may not be present.

3.4 Note becomes : Note : The functional groupings are described in relation to a layered protocol structure similar to the [OSI] X.200 Reference Model [being developed under Question 27/VII] in Recommendation X.200. ... [the OSI] this

3.4.1 second item:

- Layer 1 line maintenance functions [, such as test loops] and performance monitoring :

3.4.1 fourth item:

power [feeding ;] transfer;

3.4.2 changes : ... [OSI] X.200 ... NT2 functions [are] include:

3.4.3 changes : [OSI] X.200

3.4.3 last item :

- connection functions to other [terminal] equipments

3.4.3.1 change : ... the ISDN user/network interface Recommendations ... complies with the ISDN user/network interface Recommendations.

3.4.3.2 change: ... or interfaces not included in [recommended by] CCITT Recommendations.

3.4.4 change : ... [OSI] X.200 Reference Model that allows a TEE terminal to [connect at] be served by ...

ANNEX 9-2

4.1 changes: Figure 2 gives examples of configurations illustrating combinations of physical interfaces at reference points R, S and T [separately at S and T, at S only, at T only, and where S and T coincide; each of these is shown with and without a reference point R in the configuration.]

Figures 2a and 2b show separate interfaces at S and T; Figures 2c and 2d show an interface at S but not T; Figures 2e and 2f show an interface at T but not S; Figures 2g and 2h show an interface at S and T where they coincide. Additionally, Figures 2b, 2d, 2f and 2h show an interface at reference point R.

4.2.1 last sentence : Figure 4b) [describes] illustrates ...

New 4.2.6:

4.2.6. In addition to the examples of physical implementations shown in Figures 3 and 4, a possible combination of NT1, NT2 and TA into one physical entity could be considered, in which both reference points S and T exist but are not realized as physical interfaces. Such an implementation is to be considered an interim means of providing connection to an ISDN and might be used to complement the recommended means of connecting terminals via physical interfaces at reference points S and T in the early stages of ISDN implementation. This should not be considered as a reference configuration because it poses significant problems in relation to the models of ISDN presently being studied.

New 4.2.7

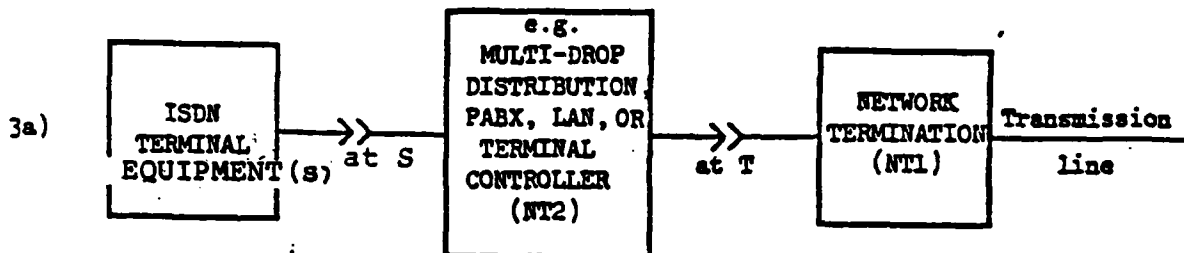
4.2.7 These physical implementations are limited in their arrangements and combinations by the electrical and other characteristics of the interface specifications and equipment.

4.3 add new sentence at the end : Examples of physical implementations shown in Figures 3 and 4 may also apply to hybrid access arrangements.

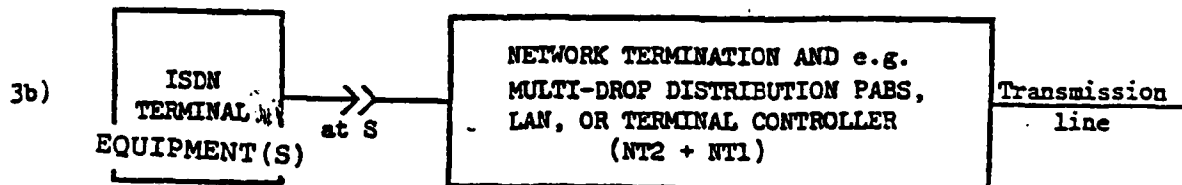
Figure 3 : changes attached

Figures 4a and 4b: change the direction of the arrows to the right of reference point T.

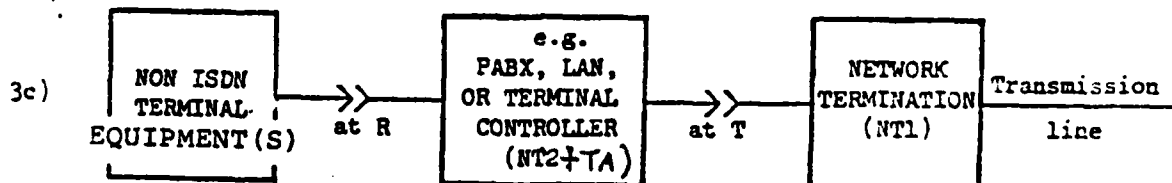
ANNEX 9-3



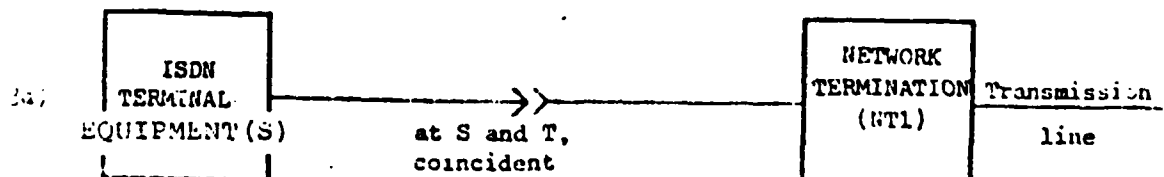
An implementation (see Figure 2a) where ISDN physical interfaces occur reference point S and T.



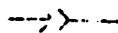

An implementation (see Figure 2c) where an ISDN physical interface occurs at reference point S but not T.



An implementation (see Figure 2f) where an ISDN physical interface occurs at reference point T but not S.



An implementation (see Figure 2g) where a single ISDN physical interface occurs at a location where both reference points S and T coincide.

 Physical interface at the designated reference point
 Equipment implementing functional groupings

ANNEX 10

Proposed Revisions to Draft Recommendation I.XXY; see COM XVIII No. 132

[...] = delete ... = insert

¶2.1 change: ... [the] an interface[s].

¶2.2 change: ... Channel types are [defined] specified in section 3.¶2.3 change: ... Channel structures, [defined] specified in section 4.

¶2.4 insert a new sentence between the first and second sentences:

Some ISDN services will not require the full capacity of a B channel; in those cases in which users require only such services, the access capability might be further reduced.

¶3.1.2 item iv) delete: ... [carried toward the same destination.*)]

¶3.1.3 item ii) change:

id) packet switchig supporting packet mode terminals: and

¶3.1.4 item ii) becomes item iia)

¶3.1.4 insert a new item iib) after the last subpoint in item iia)

iib) adaption of other user rates as follows:

- 1.2 kbit/s to/from 8 kbit/s
- 19.2 kbit/s to/from 32 kbit/s
- 56 kbit/s to/from 64 kbits/s.

¶3.1.5 change the third sentence as follows:

The other is based on the use of statistical multiplexing techniques ([see section 3.1.3, case ii] using either D channel or X.25 protocols).

Page 15, delete footnote at the bottom.

¶3.2.2 add after the end:

In certain cases where such signaling is not being utilized, the D channel may support only teleaction information or packet switched data. In a hybrid access arrangement (see section 5.2) the D channel will also carry none, some or all of the signaling information for the analogue channel.

¶3.3.1 add at the end a note:

Note: Studies are in progress to determine whether the D channel can replace the C channel for hybrid access.

¶3.4 insert a new section, labeled 3.4 and change the current 3.4 to 3.5:

3.4 E-Channel

An E channel is a 64 kbit/s channel. It is primarily used to carry signalling information for circuit switching by the ISDN. At the user/network interface it is used only in the primary rate multiplexed channel structures as an alternate, arrangement for multiple access interface configurations.

ANNEX 10 -2-

The E channel uses the CCITT Signalling System No. 7 procedures.
The network call control procedures of the E channel are
compatible with the layer 3 protocols of the D channel used in the
primary rate multiplex structures at the user/network interface.

¶3.5 becomes 3.6 and is changed:
For further study [(e.g., channels carrying information according to
Signalling System No. 7)].

¶4 changed as follows:
ISDN user/network physical interfaces [as] at ISDN reference
points S and T shall . . .

¶4.1.3 add at the end of the first alinea:
... by the network [..], and therefore the [The] following
basic access capabilities are [therefore] possible:

- 2B + D
- B + D: or
- D.

¶4.4.1 All replaced by the following (rearrangements and deletions not shown):

4.4.1 Primary Rate Multiplex Channel Structures

4.4.1.1 The primary rate multiplex channel structures are
composed of B channels and one D channel. The bit rate of this D channel is
64 kbit/s.

4.4.1.2 At the 1544 kbit/s primary rate the channel structure is
23B + D.

4.4.1.3 At the 2048 kbit/s primary rate the channel structure is
30B + D.

4.4.1.4 (same text as current 4.4.1.6)

Note: the question of whether a D channel in one primary rate multiplex
channel structure can carry the signaling for B channels in another primary
rate multiplex channel structure and the switching are for further study.

¶4.4.2 insert a new section 4.4.2 and renumber the current 4.4.2 to 4.4.3

4.4.2 Alternative Primary Rate Multiplex Channel Structures

4.4.2.1 In the case of a type of NT2 which would typically be
connected to the ISDN by more than one primary rate multiplex access
interface, it might be desirable in certain situations to employ the signaling
network capabilities of CCITT Signaling System No. 7. In such a case, the
alternative primary rate multiplex

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[This page retyped by NCS.]

TD.49

ANNEX 10 -3-

channel structures could be used, although the D channel is preferred.

4.4.2.2 The alternative primary rate multiplex channel structures are composed of B channels and an E channel.

4.4.2.3 At the 2048 kbit/s primary rate the channel structure in 30B + E.

4.4.2.4 At the 1544kbit/s primary rate the channel structure in 23B + E.

4.4.2.4 With the alternative primary rate, ... (continued as the current 4.4.1.6)

¶4.4.2 becomes 4.4.3

C.C.I.T.T.

Temporary Document No. 58

Study Group XVIII
(Group of experts on ISDN matters)

Kyoto, 14-25 February 1983

SOURCE : Chairman of Working Team 1

TITLE : 10.2 of the report and Annex 8 (ref.TD49)

10.2 Study Group VII asked whether multiple terminals could be associated with a single TA. Annex 8 to this report provides the response : a single TA supports a single terminal; however equipment including TA and NT2 functions can support multiple terminals.

ANNEX 8Reply to SGVII on Number of R Interfaces on a TA

The TA functional grouping is defined as providing adaption from a single non-ISDN interface to a single interface meeting ISDN Recommendations. However, equipment providing TA functions may support multiple interfaces at reference point R. The manner of this support is based on whether the capability exists to identify separate ISDN addresses over the common signalling channel. In general, this equipment uses the full ISDN address to discriminate the specific interface at reference point R. Figure 1 illustrates a simple relation of two TA functions (using virtual interfaces at reference point S). Figure 2 illustrates the use of other NT2 functions.

When such equipment (as a single ISDN address, it is possible to *accommodate* support multiple interfaces in some fashion not dependent on the signalling protocols. For example, assigning incoming call requests on a rotary basis *(e.g., a hunt group)*).

When such equipment has multiple addresses on a single ISDN interface, the equipment can use the address to denote the specific interface of R. If the TA is multiplexing packets onto a D channel, the various ISDN addresses together with virtual circuit numbers may be easily mapped to an X.25 interface.

Due to the possible use of the ISDN address for situation, such as direct inward dialling by a PABX, the possibility that some ISDNs might not provide an address that is sufficient to be used as a discriminator by the equipment implementing TA functions is for further study.

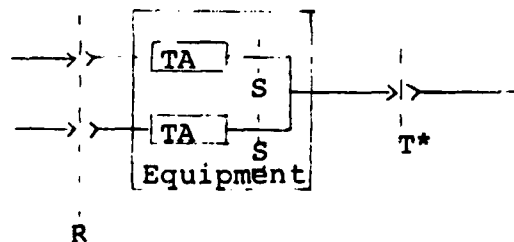


Figure 1

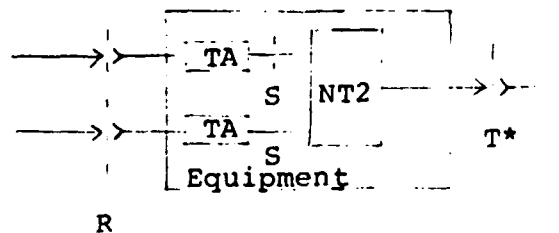


Figure 2

* This interface, even though meeting ISDN Recommendations does not necessarily correspond to a particular reference point (see paragraph 10.3 of the report).

C.C.I.T.T.

Temporary Document No.55

Study Group XVIII
(Group of Experts on ISDN matters)
Kyoto, 14-25 February 1983

SOURCE: Chairman of Working Team 2

TITLE: Report of Working Team 2
-----GENERAL

Working Team 2 (Basic access - Layer 1 characteristics) met under the chairmanship of Mr. U. de Julio (SIP - Italy). The following documentation was available for the meeting.

COM XVIII - R14 (Report of the Florence meeting, November 1982)

COM XVIII - Nos. 89 (S.G. XVII), 134 (Drafting Group on the structure of ISDN Recommendations), 142 (ISO), 147 (IBM-Europe), [148 (Sweden)].

Temporary Documents - Nos. 2 (S.G.XI), 3(S.G.XVII), 7(S.G.VII), 16(Special Rapporteur of W.P. XI/6), 18 (Special Rapporteur of S.G.VII), 20 (Chairmen of working Team 2).

Delayed Contributions HD(ECMA), HJ (Switzerland), [HK(ISO)] [HL(ISO)], HM and HN (ISO), HO(FRG), [HP(NTT)], HT, HU and HV(NTT), IG(France), IP, IQ and IR (ATT), [IU(Canada, BNR)], IV (Canada, BNR), [IW (Canada, BNR)], IY (Switzerland), JM and JN (Canada, TCTS), JQ (Sweden), JT (Ellentel), JU (Australia), JV (Switzerland), [KD (Plessey Telecom)], KE and KF (Philips' Telecommunicatie Industrie B.V.), KH and KI (British Telecom), KM, KN, KO and KP (USA), KQ (FRG), KV(ITT), KW (Advanced Micro Devices), KY (FRG), KZ ISO), LA (ISO), LB (FRG), LD (BT).

The contributions in [] have been considered of primary importance for other Working Teams.

1. REVIEW OF THE ACTIVITY OF OTHER STUDY GROUPS

1.1 Contributions COMXVIII No. 89 and Temporary Document No.3, both originated by S.G. XVII were not discussed because they had already been considered at previous meetings in Munich (February 1982) and Florence (November 1982), respectively.

1.2 T.D. No.2, which is an extract from COMXI R21 (Report of WP XI/6) was introduced by Mr. A. Whall (BT), Rapporteur of S.G.XI on Level 1, who outlined the following aspects of

interest for the Working Team, resulting from the last December meeting of S.G.XI.

i) WPXI/6 took note of the results obtained at the Florence meeting of experts of S.G.XVII and attempted to build on those results;

ii) the D-channel access control mechanism based on the use of the echoed-D-channel, originally proposed by the Rapporteur for Contention Resolution and supported at the Florence meeting, will form the basis for the relevant part of Rec. Q.910;

iii) an inter-frame time-fill signal of all 1's has been considered as the preferred solution for the direction TE → NT while further study is needed for the direction NT → TE;

iv) the agreement that two priority classes should be provided as a service from Layer 1 to higher layers;

v) the agreement that an abort mechanism should not be specified;

vi) the agreement on the basic features of the activation/deactivation procedures;

vii) the preliminary discussions on maintenance and test loops (locations, procedures, control).

1.3 Temporary Document No.16, that was also introduced by Mr. A. Whall, contains a proposal for Draft Rec. Q.910, on functional and procedural requirements for Layer 1 of the ISDN local access.

It was recognized that some parts of this Draft could be merged with other parts dealing with frame structures, line code, electrical characteristics, etc, to form a comprehensive Recommendation (I.1130) on the basic access Layer 1 characteristics.

1.4. Temporary Document No. 18 (Rapporteur on Q20/VII) was considered to be of primary importance for other Working Teams.

2. REVIEW AND COMMENTS ON THE RESULTS OF THE FLORENCE MEETING

With reference to COM XVIII R.14, the Chairman shortly summarized the results obtained at the Florence meeting of Experts on Level 1 characteristics of the basic interface, in order to know the current position of the various Administrations, RPOA's and Organizations on the preliminary agreements reached at that meeting.

2.1. Introducing their contributions, most delegates expressed their support for the solutions adopted in Florence. Delayed Contribution HO (FRG) contains a proposal for a Draft Recommendation on Layer One Specification produced on behalf of some European Administration. This proposal is based on the results of Florence, specially for the parts dealing with functional characteristics (framestructure, line code, DCAC, etc.) and suggests also some new or amended items - In particular it proposes:

- the adoption of maximum attenuation and delay values (instead of maximum lengths) on the reference configuration;
- the possible adoption of two types of NT with fixed and adaptive receiver timing, respectively;
- two priority classes for access to D-channel and two priority levels in each class, in order to provide a fair distribution of capacity within terminals of the same class;
- general characteristics for activation/deactivation;
- preliminary figures for some electrical characteristics

Delayed Contribution HJ & IY (Switzerland) are also based on the Florence results. The former suggests a small amendment to the frame structure adapted as reference in Florence, while the latter presents the results of experiments performed with a passive bus arrangement and suggest some provisional specifications for the electrical characteristics.

Del. Contr. JT (Ellemtel), on the basis of an experimental realization concludes that, with the Florence solutions, a passive bus configuration can operate satisfactory up to 150m with 16 terminals; in case of extended bus, the same NT can be used up to 1000+150m but it could be convenient to limit to 8 the maximum number of terminals.

Del. Contr. KH (BT) shows the results of experiments carried out in order to answer some questions related to the use of pseudoternary code, branch star (extended bus) configuration and variable decision thresholds.

2.4 The functional and physical/electrical characteristics identified at the Florence meeting were commented by ISO in Del.Contr.HM and HN. The first contribution requests the capability for simple TE's to be interconnected to the T interface without provision of D-channel access control functions as required in multiterminal installations like e.g. passive bus. Moreover it addresses some points on test loops (requirements for the user to exercise remotely his loops), power feed (flexibility to provide power feeding in either direction) and TE-TE interconnection (which is considered very important for ISO.Contr.HN discusses cable length requirements, galvanic isolation and earthing, transfer of power and connector requirements. In particular it is suggested to adopt more than 10 m. for the maximum length of stubs connected to the passive bus and values of 500 mw/40v/12.5mA) for power transfer.

3. MULTI-TERMINAL CONFIGURATIONS AND FUNCTIONAL CHARACTERISTICS

The concept of an active bus as an alternative to the passive bus led to considerable discussions on the advantages and disadvantages of the two configurations. Further elements of comparison were presented by the F.R. of Germany in contributions KQ and KY, leading to different conclusions from those presented in contributions KN and KO. In particular, Del.Contr.KY analyzed the use of the Florence results for an active-bus configuration and concluded that they lead to performances comparable with these obtainable with the proposals in Contr. KO and KP. However it was agreed that CCITT should not impose a choice of one of the two configurations but should rather aim at the definition of interface characteristics that exhibit satisfactory performances for both configurations.

It was therefore decided to give to a small group of experts the following tasks :

- to review of the results of Florence in the light of the possible drawbacks resulting from their application to a point-to-point or active-bus configuration;
- to find (if appropriate) modifications to those results, in order to guarantee satisfactory operation for all the configurations.

The group of experts, that was chaired by Mr. M. Decina (Italy), after a detailed consideration of the requirements imposed by the different configurations, was able to find a compromise solution that modifies the frame structure of Florence, while leaving unchanged the line code and the other functional characteristics of the interface. The improved frame structure, which is described in Annex 1 was considered satisfactory by all the delegates and it was therefore decided that, together with the other functional characteristics agreed at the Florence meeting, it should form the basis for the Draft Recommendation on Level 1 characteristics of the interface. However it was recognized that some detail improvements might be appropriate as result of further study before next June meeting. In this respect the list of features contained in Annex 1 should be met.

2.2. Del. Contr. IV (Canada - BNR) analyzes the passive bus and the star configurations and concludes that they are comparable in terms of maintenance, transmission capabilities to meet application requirements, equipment complexity and performance, while the passive bus has the advantage of being simple and flexible and to provide equal access for users with and without NT2.

Del. Contr. IW (Canada - BNR) describes some characteristics of customer premises wiring topologies, in terms of: NT-TE distances, differential NT-TE distances, bridged tap length. Typical values of these parameters are given for various categories of subscribers.

Del. Contr. JN (Canada - TCTS) reviews some results of the Florence meeting, and in particular the number of terminals and the probable configurations. It suggests to limit 8 (instead of 16) the number of terminal in reference configurations and provides lengths and configuration models for the definition of maximum distances for point-to-point and passive bus versions of the point-to-multipoint in premises configurations.

2.3 The position of USA on the results of Florence is represented in Delayed Contributions KM, KN, KO and KP. Starting from the consideration that the solution identified in Florence to accommodate the passive bus requires additional complexity and poses problems from the operational and administrative point of view, these contributions develop the concept of a level one star configuration (including the "active Bus") as a more convenient alternative to serve multi terminal installations with layer 1 functions only.

Del.Contr.KM examines the alternatives to solve the problem of multi-terminal installation with few TEs and concludes that level one star arrangements is preferable to the passive bus. Del.Contr.KN also discusses NT2, passive bus and active bus arrangements and examines the last solution in more detail describing a possible frame structure and showing the possible physical distribution options : basic NT1-star, remote NT1-star, distributed NT1, that can be used within the concept of the "active bus".

Del.Contr.KO presents a detailed comparison of the performances of "passive" and "active" bus solutions and concludes that, due to the use of simple point-to-point connections, the active bus maintains the potential advantages of the passive bus but greatly simplifies operation and administration problems. Del. Contr. KP describes a D channel contention resolution mechanism which exhibits satisfactory operating characteristics in all active bus configurations. Having assumed the basic requirements for the DCAC, the proposed mechanism is described in terms of contention parameters (request, grant, device and bus priority indicators) and functions of the various elements of the system, i.e. TE, bus expander and NT1.

Additional issues unrelated to the frame structure were discussed but require further study. Examples are : means of ensuring the proper interchange circuit termination for passive bus and point-to-point configuration and means to indicate to a TE that it is connected to the network.

4. ACTIVATION/DEACTIVATION

Several contributions were available on this matter, dealing with both general requirements and detailed description of the procedures and of the signals to be used.

T.D.2 (XI/6) and Del.Contr.HO (FRG) both contain a list of general requirements; in addition, TD.2 (Annex 2) also indicates, as a possible basis for further study, how the activation and deactivation procedures could be defined.

Del.Contr.HT (NTT) proposes, for activation/deactivation, a state diagram conceived for the definition of various transmission failures in the subscriber line.

Del.Contr.IQ (ATT) examines advantages and disadvantages of a "fully" or "partial" deactivation of NT1 and concludes that further study is needed to evaluate the impact of activation and deactivation procedures on system performances and cost and complexity of NT1.

Del.Contr.IR (ATT) proposes a method of "global activation" for all TE's and NT2s in a customer installation, in response to a Layer 1 signal from the exchange; each TE (or NT2) can then autonomously deactivate using Layer 2 and Layer 3 protocols, as described in more detail in a companion Contribution (Del.IS) to be examined mainly by Working Team 5.

Del.Contr.JQ (Sweden) describes a layer one activation procedure applicable at S and T reference points. The activation procedure is based on the reframing of deactivated TE's on a dedicated pattern (framing and all 's) sent by the NT when there is an activation request from a TE or from the network. Deactivation is performed by stopping the transmission from NT, which will cause each TE losing synchronization and stopping transmission.

Del.Contr.JV (Switzerland) describes detailed procedures of activation and deactivation based on the preliminary results achieved in S.G.XI. The activation procedures include a test loop of the B and D channels. Messages across the interface are based on the presence/absence of framing and an asynchronous burst is used in case of activation request by a TE.

Del.Contr.KF (Philips) also contains a proposal for activation/deactivation based on the results of the Florence meeting and of the last meeting of WPXI/6. The procedure proposed is based on the identification of three mutually exclusive signals that can be sent by TE's and three mutually exclusive signals that can be sent by NT. It identifies a "complete" and a "partial" power down mode for TEs, in order to minimize power consumption.

Del.Contr.LA (ISO) was issued during the meeting by ISO to draw the attention of the experts working on activation/deactivation to the problem of unattended terminal devices (switched-off during the night) called by another part of the world (during the working hours) and proposes a possible solution that in any case requires a delayed answer capability.

After a short discussion that followed the introduction of the various contributions, it was decided to establish a small group of experts, chaired by Mr.W.E. Henry (ATT), that should examine the details of the various proposals, with the following objectives:

- to agree a set of general requirements for activation/deactivation;

- define the appropriate layer 1 procedures or, when not possible, identify advantages and disadvantages of alternative resolutions;

- define the signals across the interface.

The report of the experts group as approved by the Working Team is reproduced in Annex 2. The main results obtained can be summarized as follows.

- a list of general characteristics for activation/deactivation was agreed;

- time diagrams that describe the procedures for activation/deactivation and state diagrams for NTI and TE have been agreed as basis for further study;

- coding of signals across the S/T interface have been defined.

Annex 2, par. 5 contains also a detailed list of items for further study.

Since it was the first time that activation/deactivation were discussed in detail, it was agreed that the solutions identified in Annex 2 require further consideration and need to be confirmed at the next June meeting.

At the end of the meeting, delayed contribution LF was submitted by Switzerland. [This outlined an alternate activation / deactivation procedure that will be considered by the study group at the June meeting in Geneva.]

The following contributions were available on this matter.

Del. Contr. HO (FRG) proposes a reference configuration with 4 wires only (leaving under study the optional use of additional wires) with power feeding over the phantom, in the direction NT → TE only.

Del. Contr. HV (NTT) proposes a reference configuration with a basic 4-wire arrangement for powering from NT to TE over the phantom, and additional 4 wires (optional) for symmetric powering from TE thus resulting in an 8-pin connector.

Del. Contr. IG (France) discusses the possible alternatives of powering TE's from via the phantom from NT or using a separate pair and considers the impact of normal emergency service on this problem. It concludes proposing a reference configuration with 6 wires, with restriction of power feeding from NT1 through the phantom to the emergency service and use of the third pair for the provision of additional, normal power supplied locally.

Del. Contr. IP (ATT) proposes that for basic access no power should be provided by the exchange to TEs or NT2s, neither in normal nor in emergency situation; power to customer equipment may originate from a power supply contained in NT1 or NT2 and in case of a commercial power failure, a local battery back-up could be used.

Del. Contr. KE (Philips) examines the possible power requirements for terminals in typical passive bus installations and derives a proposal for voltage and current specifications at the interface. It also identifies a procedure that could be used in emergency situations.

Del. Contr. KI(BT) considers power ranges at the interface if power is supplied by the network and, making some assumptions about T1 consumption concludes that about 600 mW may be appropriate. When power is locally supplied by a mains unit a maximum value of about 2W may be appropriate.

Del. Contr. KW (AMD) examines the power budget on the subscriber line considering the various parameters involved, i.e. exchange battery voltage, loop resistance, power consumption of NT1 and emergency powering for a telephone set.

A short discussion took place on the total number of wires needed to provide in addition to the bidirectional transmission of signals also power feeding from NT to TE. It was agreed that a 4-wires solution with power on the phantom can be sufficient, at least to provide an emergency service. However, it was also agreed that, in order to allow different applications like e.g. power on separate wires and/or TE to TE interconnection, it is appropriate to foresee an 8-pin connector, being optional the use of the additional wires, according to the application.

In order to proceed with definition of a reference configuration and corresponding values of power at the interface, a small group of experts, chaired by Mr. J.M. Chamborde (France), was set up.

- to analyze possible arrangements of power feeding at the interface, on the basis of the reference configuration of Fig. 1 in Del. Contr. HV, taking also into account the aspects of normal and emergency service;
- to propose ranges of power to be provided at the interface

The report of the experts group as approved by the Working Team is reproduced in Annex 3. The main results obtained can be summarized as follows :

- a unique reference configuration for power feeding at the interface has been agreed; this configuration is based on a unique number of 8pins connector; the use of 4 access leards is mandatory, the use of the remaining 4 is optional (see Annex 3 fig. 1).
- Values of powers $P_A=250$ mW and $P_B=240$ mW have been defined;
- a voltage of 40V has been considered appropriate *when if* power source 1 is ~~supplied~~ *defined* in NT1 as a voltage source.

6. MAINTENANCE ASPECTS

Most of the contributions available on this subject addressed general problems of maintenance of the subscriber line. However, it was agreed that only the possible impact on Level 1 interface specifications had to be discussed during the meeting, because a general approach to the maintenance philosophy of the ISDN has first to be defined by Working Team 3.

Contribution 148 (Sweden) contains a Draft Recommendation for the maintenance of digital subscriber line and was presented on behalf of several European Administrations. The Contribution describes the automatic supervision (during calls and continuous), the loops for failure detection the loops for performance test and/or measurements and the loops for failure localization.

Del. Contr. HD presents the views of ECMA on the loops to be provided on the subscriber line. It outlines that at least one loop 2 should be controllable by the remote end point.

Del. Contr. HT(NTT) deals with the problem of location of transmission failure detection and related alarm indication signal transfer. Two alarm indication signals are identified, i.e. the framing signal and a Layer 1 Ready(LR) bit.

Del. Contr. HU (NTT) discusses various issues related to test loops (location, control, physical conditions at the interface, etc.) and concludes that loops 1, 2 and 3 should be defined as loopback locations, that loop 2 may include local and remote loopback, that loop 2 should provide entire (B+B+D) and selective (each B and D) channel loopback.

Del. Contr. LD (BT) proposes a functional definition of loops (physical, logical, transparent) and discusses the problem of loop control. Concerning the last item it suggests the use of D-channel to control the loops both on the customer side and on the network side of the T-interface.

A discussion took place on the means to control by the network the test loops, in order to identify possible impacts. on layer 1 at the S/T interface. It was agreed that:

- loops on the customer side of the interface should be controlled by using standard D-channel messages;

- for control of loops on the network side of the interface (on NT1) two solutions were mentioned, i.e. use of appropriate layer 1 functions, like e.g. housekeeping bits in the line transmission frame, or use of particular messages over the D-channel (see e.g. Del. LD) that should be detected by NT1 by simple layer 1 functions. Further study is necessary on this point.

Therefore it was agreed that additional layer 1 functions have not to be foreseen at the S/T interface for control of loops.

7 - DRAFT RECOMMENDATION I.1130

On the basis of the results obtained it was possible to agree a first Draft of Rec. I.1130, that is attached as Annex 4 to this report.

ANNEX I

A.053

IMPROVED FRAME STRUCTURE

1. Introduction

During the meeting the discussion has identified the following problems of the frame structure proposed in the Florence report:

- (i) Secure framing cannot be guaranteed when the wires are interchanged
- (ii) No spare bit in the direction TE → NT

To overcome the mentioned problems a frame structure is proposed which has the following features:

- 1. secure framing in the case of interchanged wires for both NT to TE and TE to NT directions
- 2. Multiframe possibility
- 3. detection of whether a terminal is connected to an NT or to another TE by use of different multiframe-coding
- 4. improved timing information by presetting unused spare bits to binary "0"
- 5. symmetric frames for transmit and receive direction
- 6. freedom of processing time of E-bits by frame offset of two bits between received and transmitted frame
- 7. interface bitrate and baudrate are not increased
- 8. the range of a passive bus configuration is not affected

2. Frame structure (Figure 1)

2.1 General Aspects

In both directions data are grouped into frames of 48 bits each. The frame structure is identical for both point-to-point multipoint configurations (passive bus configuration). Each frame consists of several groups of bits. The normal repetition period is 250 microseconds.

At the terminals the timing signals derived from the received frames is used as transmit timing. A time shift of two bits exists between received and transmitted frames. The leading and trailing edges of each transmitted bit may differ less than ± 5% of a bit period from the respective edges of the received bits.

2.2 Frame Structure from the Terminal to the NT

Each frame consists of the following groups of bits:

- framing signal
- B1-channel with trailing DC ballance bit (L-bit)
- D-channel bit with trailing DC ballance bit (L-bit)
- B2-channel with trailing DC ballance bit (L-bit)
- F_A /Spare bit with trailing DC ballance bit (L-bit)

Within each group of bits the first pulse different from zero is negative, only in the framing channel the first pulse is positive. All terminals active at Layer 1 transmit simultaneously the framing signal.

2.3. Frame Structure from NT to the Terminal

Frames transmitted by the NT contain an echo-channel used to re-transmit the D-bits received from the terminals as E-bits. The D-echo-channel is used for contention resolution. The last L-bit of the frame is used for ballancing each complete frame.

An auxiliary framing bit (F_A -bit) guarantees a secure and information channel contents^A- (data-) independent framing also in the case of interchanged wires. The F_A -bit is a negative or positive Mark according to the coding^A rule. The F_A bit allows a secure framing of both NT and TE, provided the maximum round trip delay is limited to a value of less than 10 bit periods (approximately 2.5 km in a point to point configuration).

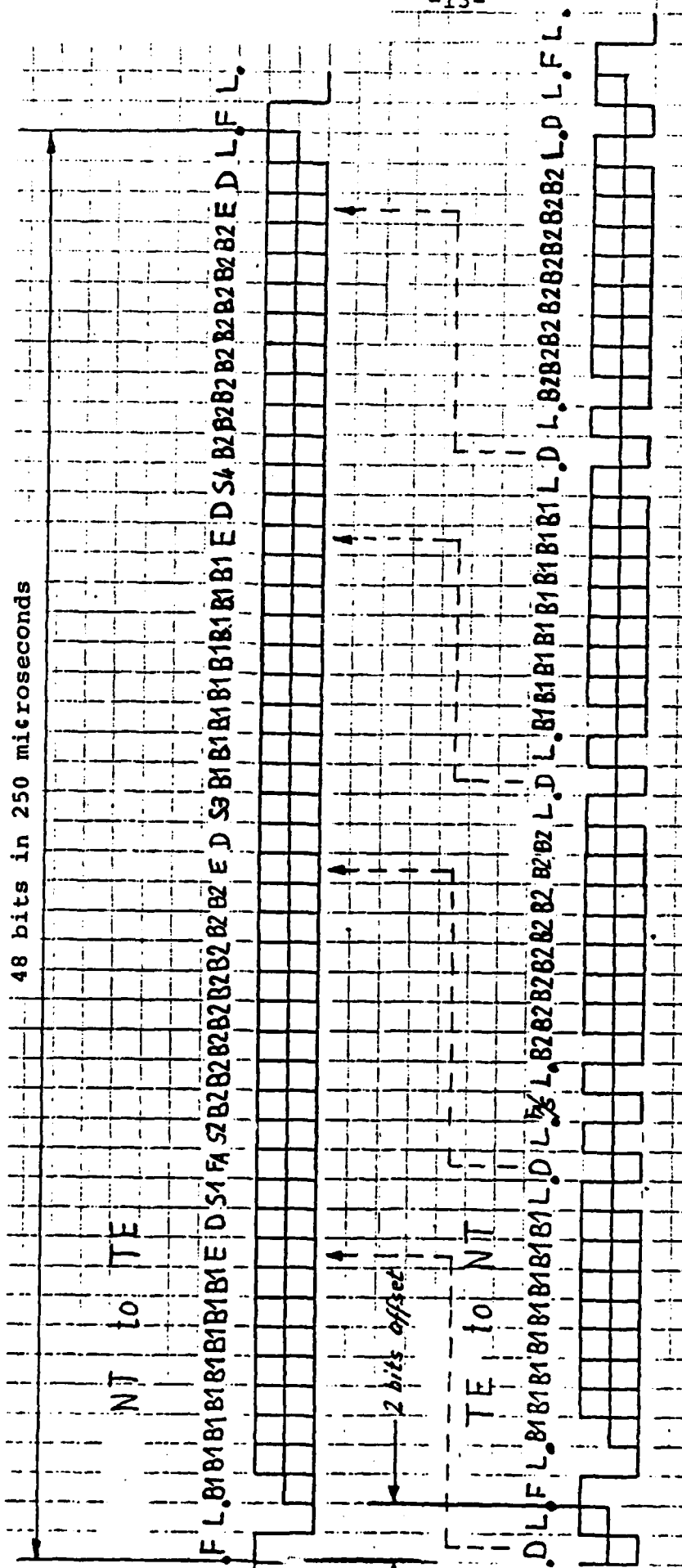
Unused spare bits are set to binary "zero".

2.4 Multiframeing

Multiframeing can be achieved by:

NT to TE direction: every fourth F_A bit is set to binary "one".

TE to NT direction: every fourth F_A /S bit is set to binary "zero"



F = framing bit

L = DC balancing bit

D = D-channel bit

E = D-echo-channel bit

F_A = Auxiliary framing bit

B1 bit within B-channel 1

B2 bit within B-channel 2

Sx Spare bits

Dots mark those parts of the frame that are independantly DC-ballanced.

Figure 1 : Frame structure at reference points S and T

ANNEX 2

(to the report of Working Team 2)

Report of Ad Hoc Group on Activation/
Deactivation Procedures for the Basic Channel Structure

The group met under the chairmanship of Mr. W.E. Henry (ATT-U.S.A.)

The group was given the following terms of reference:

1. List the general requirements for activation/de-activation for basic channel structure at reference points S and T.
2. Define state diagrams for activation and deactivation procedures.
3. Define the signals to be transferred across the interface at reference points S and T.

1. CONTRIBUTIONS CONSIDERED

The following documents were considered in the discussion of activation/deactivation:

COMXVIII No. R14, Temporary Document No. 2-E, Extract from COMX1-R21, Annex 2 (to Part 4), Delayed Contributions HO (FRG), HT(NTT), IQ(ATT), IR(ATT), IS(ATT), JQ(Sweden), KF(Philips) JV(Swiss), LA(ISO), LB(FRG) and COMXVIII-No. 132.

2. GENERAL REQUIREMENTS

The Group revised the General Requirements defined in Temporary Document No. 2 and Delayed Contribution HO (FRG)

1. The same procedure should apply to all types of in house distribution systems defined as reference configurations in COM XVIII - No. R 14, COM XVIII -No.132 and does not restrict the number of terminals to be connected.
2. The procedure applies when terminal and NT equipment are line powered and when TE and NT are supplied with local power or combinations of both.
3. It should be possible to maintain the activated state at S/T Reference Point at all times depending on the application (e.g. by higher layer functions).
4. The cost of implementing the activation/deactivation procedures should be kept to a minimum.

A.057

2.5. The procedures should be defined in such a way that they result in a fault tolerant behaviour (e.g. automatic recovery from temporary disturbances).

2.6. The conditions under which activation or deactivation procedures are initiated should be indicated by means of primitives passing from Layer 2 to Layer 1 and vice-versa.

2.7. The procedures should involve only digital signals consistent with the specified frame structure; no additional bits are used at the interface. Asynchronous signals should use the specified line code.

2.8. The procedures should not exclude the possibility of connecting, in an exchange, a larger number of p, s, t information handlers to a Layer 1 structure.

2.9. The procedures should allow removal/attachment of terminals when layer 1 is active without affecting other terminal's activation/deactivation.

3. Procedures for activation or deactivation of Layer 1

3.1 Assumptions

- 1) The procedures described are based on a configuration consisting of an NT 1 and NT 2 both with layer 1 functions only or NT 2 null, as well as one or several TE's. TE's can be connected using a point-to-point or multipoint configuration, including a passive bus or active bus.
- 2) The procedures to be applied when NT 2 contains also higher layered functions are assumed to be similar. The formulation of the specific procedures is for further study.
- 3) These procedures described are based on the assumption that power is available at the TEs and NTIs.

3.2 Definitions

- 3.2.1. Activated state is the state in which Layer 1 is able to carry information in both directions according to the defined interface frame structure.
- 3.2.2. Deactivated state is the state in which Layer 1 is not able to carry information in both directions according to the defined interface frame structure.
- 3.2.3. NT 1 state are the states of Layer 1 at the T reference point as perceived by the NT 1 side of this reference point.

Eight states are identified:

a1	:	fully deactivated state
b1		
b2		
b3		
c1	:	intermediate states
c1		
f1		

3.2.4 TE states are the states of layer 1 at the S/T reference points as perceived by the TE.

Six states are identified:

- a : fully deactivated state
- b : intermediate states during activation
- c : fully activated state
- d : partially activated state
- e : disconnected /switched off state

3.2.5. TE primitives* are atomic interactions between Layer 1 and Layer 2 within the TE.

Six primitives are identified:

- t1 : activation request
- t2 : activation confirmation or indication
- t3 : deactivation request
- t4 : cancel deactivate request
- t5 : deactivation confirmation or indication
- t6 : "you are now in state e"

3.2.6 ET primitives* are atomic interaction between layer 1 and layer 2 in the ET.

Four primitives are identified:

- x1 : activation request
- x2 : activation information or indication
- x3 : deactivation confirmation or indication
- x4 : deactivation request

3.2.7 NT 1 events* are events causing or resulting from NT 1 state-transitions.

Six events are identified:

- n1 : generated by detection of info 1
- n2 : initiates sending of info 2
- n3 : generated by detection of info 3
- n4 : initiates sending of info 4
- n5 : generated by detection of info 0 (upstream)
- n6 : initiates sending of info 0 (downstream)

upstream - TE → NT1
downstream - NT1 → TE

3.2.8 Signals are members of a set of information flows across the S and T reference points, which can be uniquely identified by the receiver. All TEs and the NT1 will always transmit one of these signals.

Six signals are identified:

- info 0 (upstream and downstream)
- info 1 (upstream only) (burst then nothing)
- info 2 (downstream only)
- info 3 (upstream only)
- info 4 (downstream only)
- info 5 (upstream only)

The coding of these signals is given in Section 4.

* As stated in the OSI Layered Protocol Reference Model, the implementation of primitives in ET and TE as well as the events in the NT 1 is not subject for recommendation. This document should be sent to SGVII for their consideration in their work on the reference model.

3.3. Time diagrams

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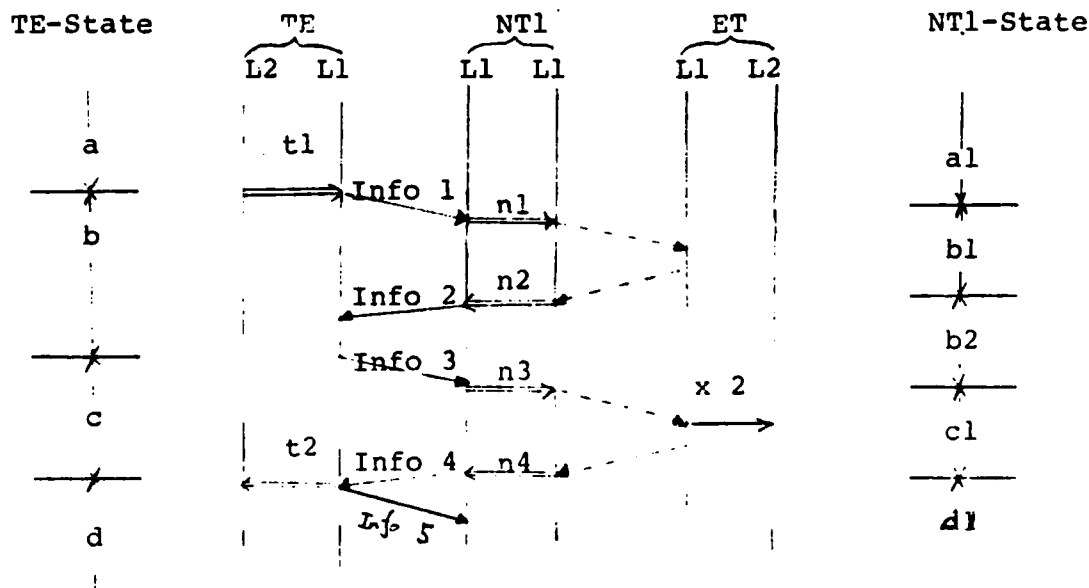
Subject of recommendation for interface S and T are:

- the primitives* in TE (t1 to t6)
- the primitives* in ET (x1 to x4)
- the events* in NT1 (n1 to n6)
- the signal flow between TE and NT1

The signal flow between NT1 and ET serves for explanatory purposes to show the necessary time relationships between the events in NT1 and the primitives in ET. They are not intended to constrain any implementation.

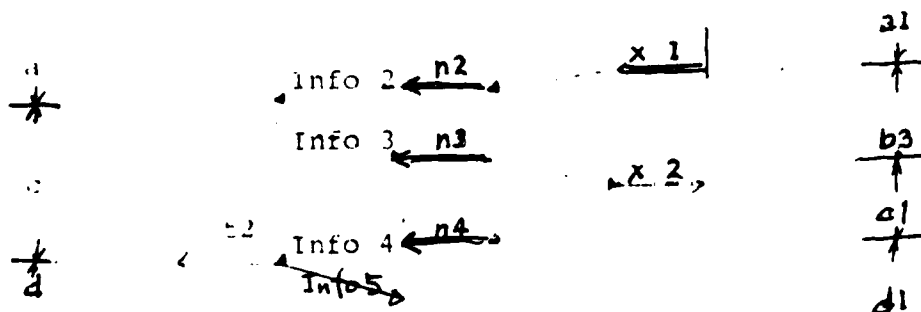
* Implementation of primitives in ET and TE as well as the events in the NT1 is not for recommendation.

3.3.1 activation caused by TE (originating activation)

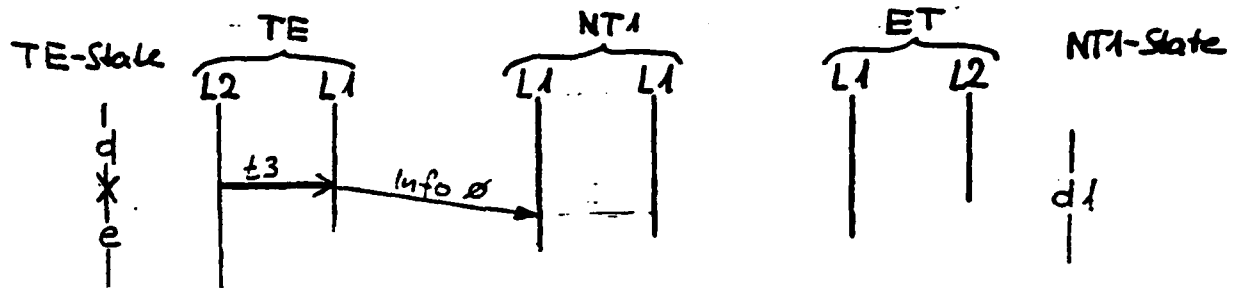


Note: The non-activating TE behave according to 3.3.2

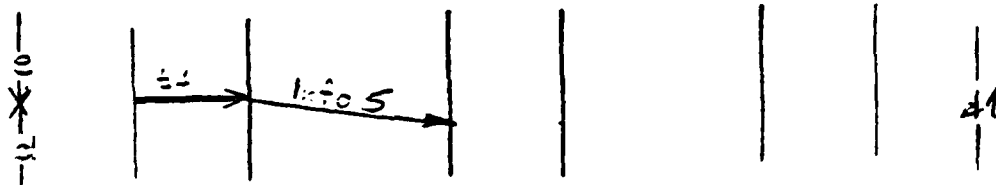
3.3.2 activation caused by ET(terminating activation)



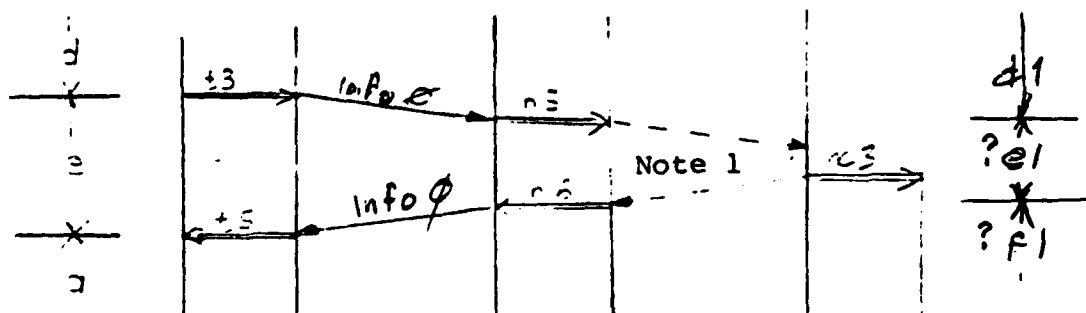
3.3.3 One TE issues a deactivation request while at least one other TE maintains Layer 1.



3.3.4 One TE begins with higher Layer activities and issues a cancel deactivation request while at least one other TE already maintains Layer 1. Layer 1 of NT1 stays in the same state.



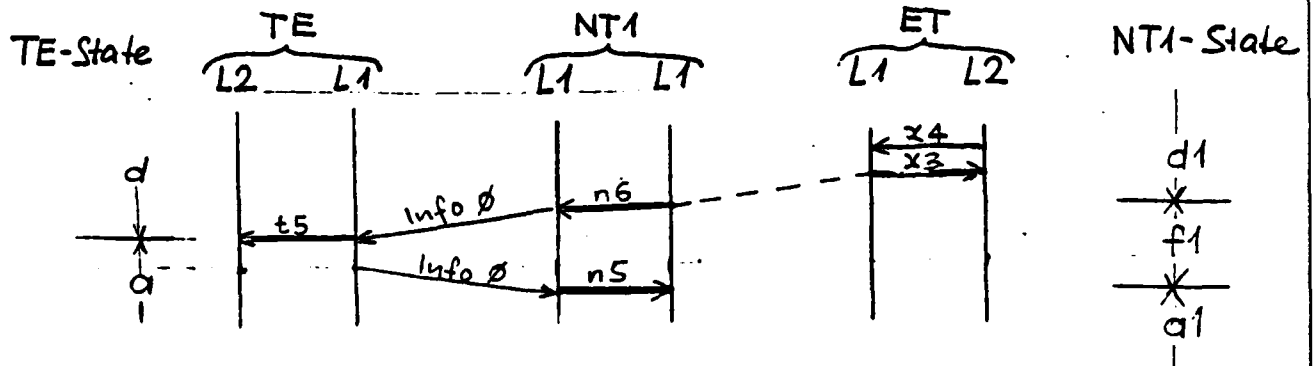
3.3.5 Deactivation caused by the last TE that releases Layer 1.



Note: These might be a Layer 1 time delay or via primitives an acknowledgement by higher ET-layers at this point. Any higher layer activity at this point is possible (see 3.3.7) and brings NTL to state d1 and the TE to state d.

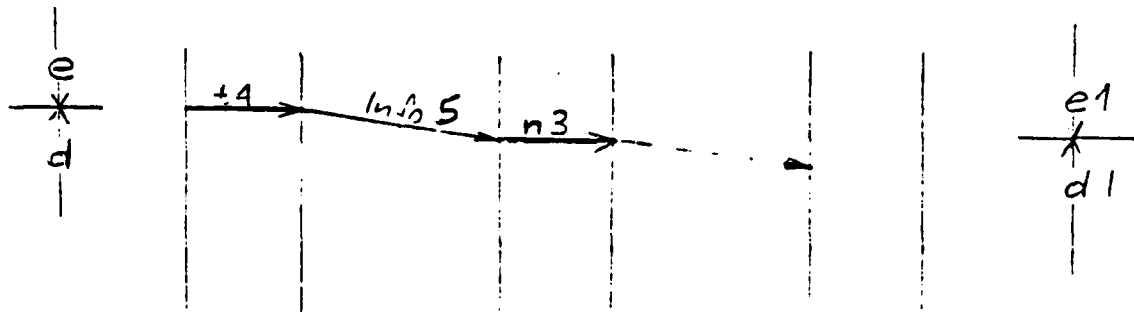
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3.3.6 Deactivation by a higher layer function in ET with corresponding compliance. The Layer 1 is deactivated independent of the states of the TE. Specific applications of this procedure are for further study (see section 5).



note: TE₃ in state e behave according to 3.3.5

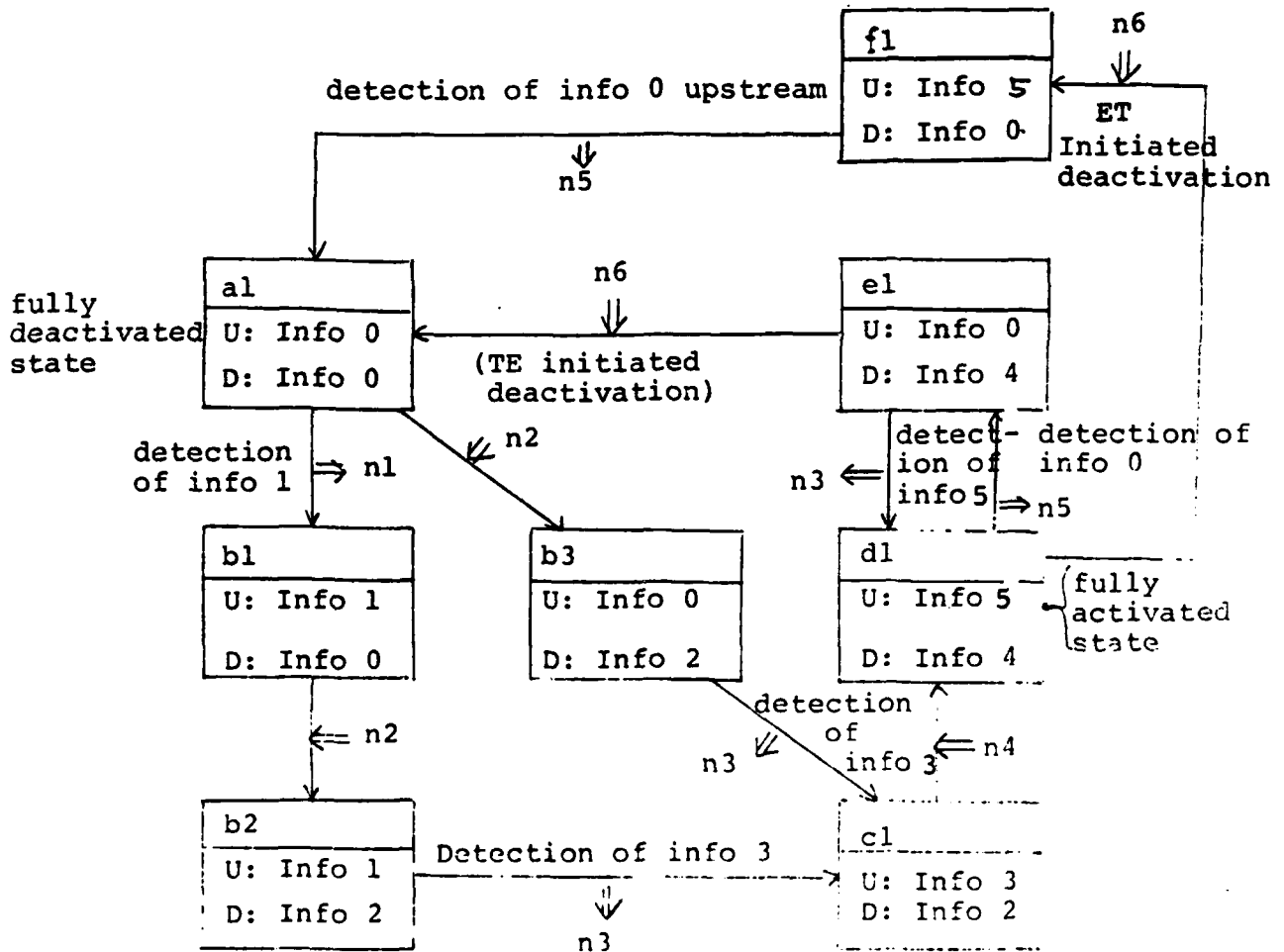
3.3.7 One TE recognizes or originates higher layer activity while NT1 is in state e1 and all TE are in state e, i.e. interrupted deactivation as mentioned in note of 3.3.5.



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3.4 State diagrams

3.4.1 NT1 State diagram



NT1 State diagram

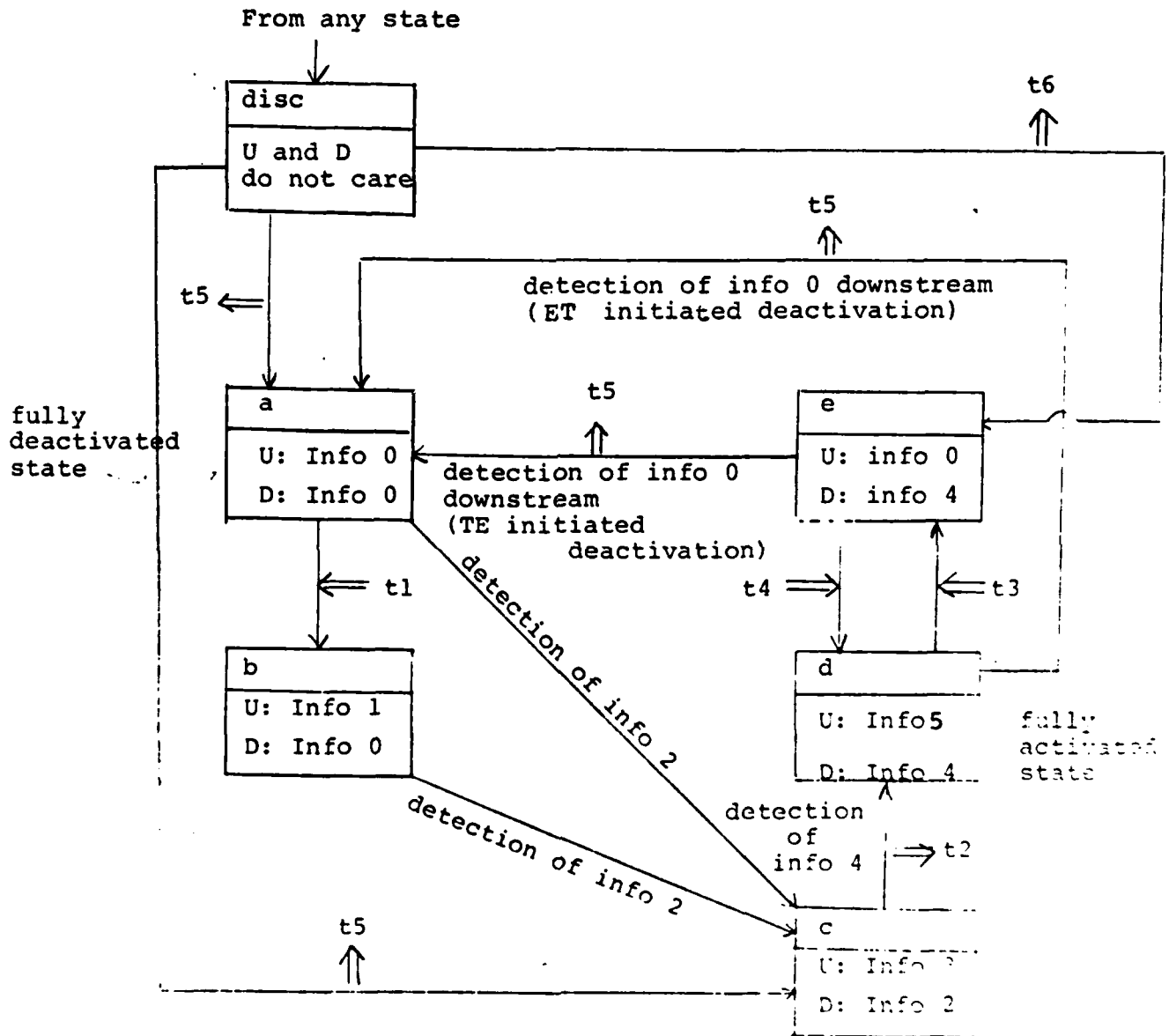
Legend : U : Upstream signal (TE → NT1)
D : Downstream " (NT1 → TE)

$n_i \Rightarrow$: event causing the state transition

$n_i \Leftarrow$: event resulting from the state transition

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3.4.2 TE state diagram



TE state diagram

Legend :

U : Upstream signal (TE → NT 1)

D : Downstream signal (NT1 → TE)

$t_i \Rightarrow$: primitive layer 2 → layer 1 causing the state transition

$t_i \Leftarrow$: primitive layer 1 → layer 2 resulting from the state transition

4. Coding of signals across the S/T reference point

The identification of the specific signals across S/T Reference Point was also discussed. The coding of these signals corresponding to the six signals indentified in section 3.2.8. are listed below.

Info 0

No signal

-No framing

-No bit transmission

Info 1

a) Unsynchronized frames + All 0's**

b) Unsynchronized **

(No frames)

(Burst* followed by no signal) may be repeated

Info 2

Frame + All 0's

Info 3

2 frames with all 0's,
then synchronous frames
with normal B, D

Info 4

frame + spare bit (1)

Info 5

Synchronous frames with
normal B, D,

*Burst characteristics should be : 1 to 2 frame lengths, normal bit rate and code, no code violations, first pulse is the inverse of the first pulse of framing.

** Should be interrupted by a valid signal from the NT1.

Further study is required with ^{respect} ~~aspect~~ to the ultimate choice of info 1 codings.

5. Items for Further Work

The following items were discussed during the course of the meeting, but no agreement was reached:

1. Maintenance - at least one administration expressed the opinion that a maintenance loopback could be made during the activation procedures. As this subject was not in the terms of reference, and due to the lack of time this subject is for further study.
2. According to the procedures described above a TE has always to receive and process information as long as info 4 is sent downstream, even in state e. An alternative proposal was discussed that facilitates a TE in state e (a "sleeping" terminal) to ignore the D channel. An NT 1 is then required to use an additional spare bit in the downstream frames to awake a sleeping TE. No consensus could be reached.
3. The procedure outlined are for ET and TE. When an NT-2 containing higher layer functions is used, how the applications of the procedures to the NT-2 to TE functions is for further study.
4. Applications of ET initiated deactivation procedures.

Concerning deactivation initiated by the ET (point 3.3.4), different opinions were expressed as to whether this is a normal procedure or merely a maintenance function. Protagonists for the former alternative claim that procedures for activation and deactivation are established to save power at the local exchange, and should consequently be controlled from the ET. Others think that the initiative for deactivation of the subscriber line is up to the terminals, which have the information of the prerequisites for deactivation more readily available. A third opinion was expressed questioning the ability of the ET to deactivate an active terminal, even in the maintenance mode. Thus, further study is needed. However, these studies probably have no impact on the specification of the interface at reference points S and T.

5. The activation/deactivation procedures described here have assumed sufficient power to be available at the NT1 and TE such that digital signals may be transferred across the interface. The implication of such an assumption on the procedures and mechanism for power transfer (e.g. powering/depowering, power contention resolution) is for further study.

- 6 . Several other items were identified for further study. This items were not discussed but were identified as important issues and are listed here for further study.

-In addition to item 1 above the issue of maintenance in general and it relationship to activation/deactivation procedures.

-Alarm conditions

-Behavior in intermediate states when an expected signal does not arrive.

-Collisions when activation and deactivation procedures are applied at the same time.

- Possibility for TE and/or ET to maintain Layer 1 active.

- The amount of time required to go from a fully deactivated state to a fully activated state needs to be specified. This should include consideration of emergency power contention.

- The application of these procedures to a TE to TE connection should be studied.

- The impact of the portability during a call on the activation/deactivation procedure.

(to the report of Working Team 2)

**TITLE: Annex 3 - Report of the Working Grouping
Power feeding for S and T interfaces**

I. Terms of reference

The working group met under the chairmanship of Mr. Chamborde (France), with the terms of reference to define:

- a reference configuration for power feeding from NT to T,
- a power allocation for equipments connecting to S/T interfaces, taking into account the problem of emergency situations

II. Reference configuration from NT to T

A detailed discussion has premitted the definition of a unique figure for power feeding terminals arrangements. Such a reference configuration is presented in Fig 1 based on an unique number of 8 pins interfaced connector. The use of 4 access leads is mandatory, the use of the remaining four is optional. This reference configuration must replace both figures 2a and 2b given in the Florence report R14.

Fig.1 has been defined in order to allow an unique type of physical and electrical requirements for S and T interfaces, independently of the choice of internal or external power sources arrangement. In particular, these various power sources might be extracted from the Telecommunication network and/or from internal power supply (including batteries).

2.1 Functions specified at the 8 pin connector

The 8 access leads are applicable for TE and NT

- a) Access leads 3 - 4 and 5 - 6 (which use is mandatory) are strictly reserved for data exchanges and may provide* a phantom circuit as described in Fig. 1

In order to provide a complete specification.

Access leads 3 - 4 are reserved for receiving data signals.

Access leads 5 - 6 are reserved for emitting data signals.

- b) Access leads 7 - 8 which use is optional are reserved for receiving additional power.

- c) Access leads 1 - 2 which use is optional are reserved for providing power (source 3) in order to feed from a

* in accordance with note 5

Reference Configuration for Power Feeding

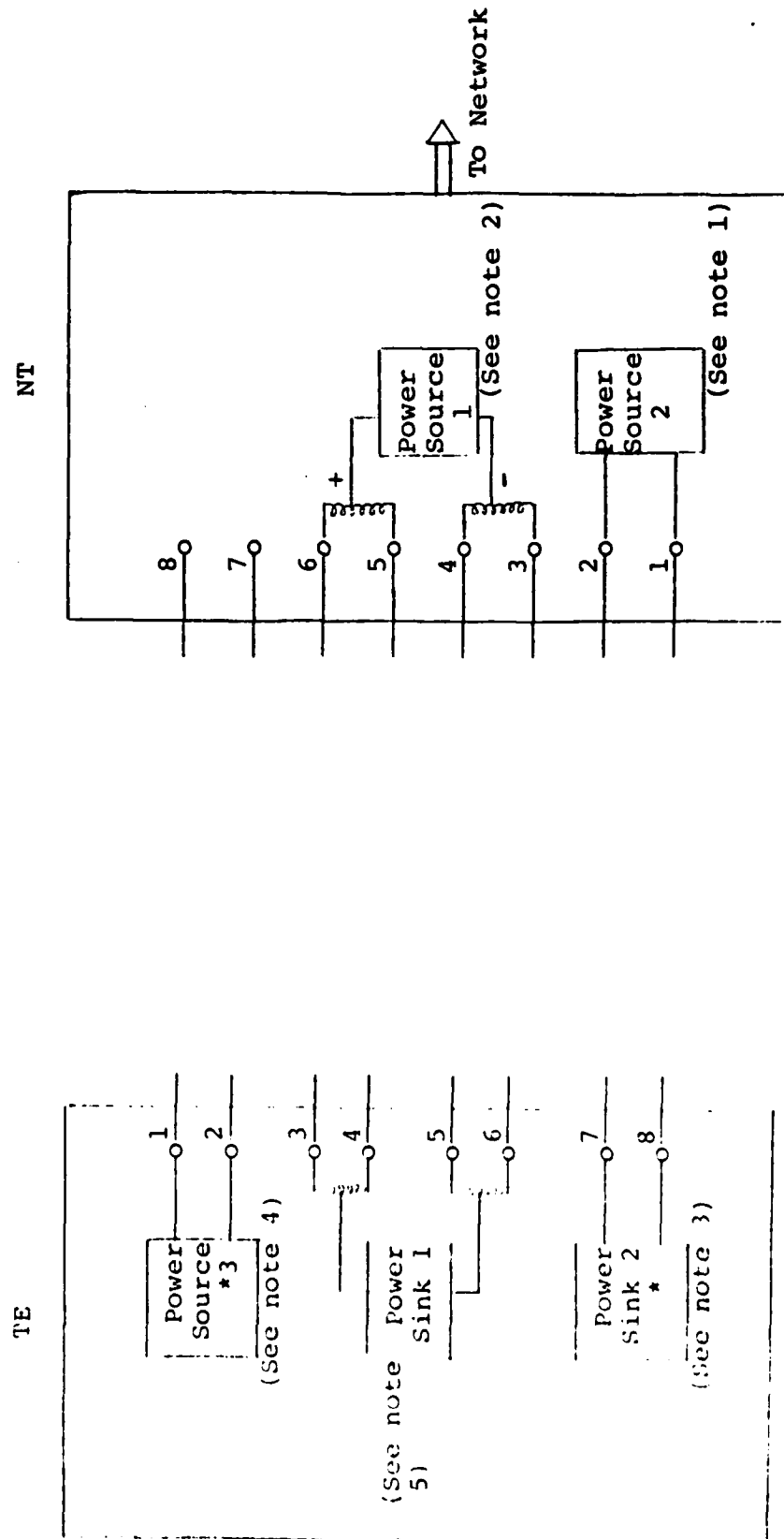


Fig.1

terminal. This power source is not to be specified in COM XVIII.

Note 1 Power source 2(NT)

Provision of this source is subject to the decision of individual Administrations.

Note 2 When the power source 1 (NT) is provided, a minimum and a maximum power available from this source on the phantom will be specified.

Note 3 Power sink 2 is optional.

Note 4 Power source 3(TE) is not a subject of recommendation in COM XVIII.

Note 5 Power sink 1 is optional. Administrations may limit the use of the power from the phantom to those terminals capable of providing "minimum service".

Note 6 The numbering of leads on Figures 1, 2 and 3 does not imply any assumption or pin allocation or a physical connector.

Note 7 Maintenance of polarity in a wire pair cannot be guaranteed in all cases. This must be taken into account for terminals drawing power from 7 and 8 access leads.

2.2. Applications

Two main applications have been identified and are described in fig. 2 and 3.

a) Application 1 may provide a limited power at least for emergency situation. In such application power source 2 may be located in the NT or outside the NT. Such a source 2 may be used for feeding power to the TE.

b) Application 2 may provide energy from power source 1 only across the phantom circuit for both cases (emergency and normal).

3. Power feeding requirements

3.1. Power

Two main possible features of power are identified for the NT.

a) Feature 1 Minimum power available from source 1 on the phantom when mains powering is unavailable or not provided at the NT.

i) A minimum value of available power P_1 on phantom circuit has to be specified for power source 1 in the NT. Such a value of P_1 might be 250mW and may be the only available power in case of emergency, for example, when no other power source is available.

APPLICATION 1

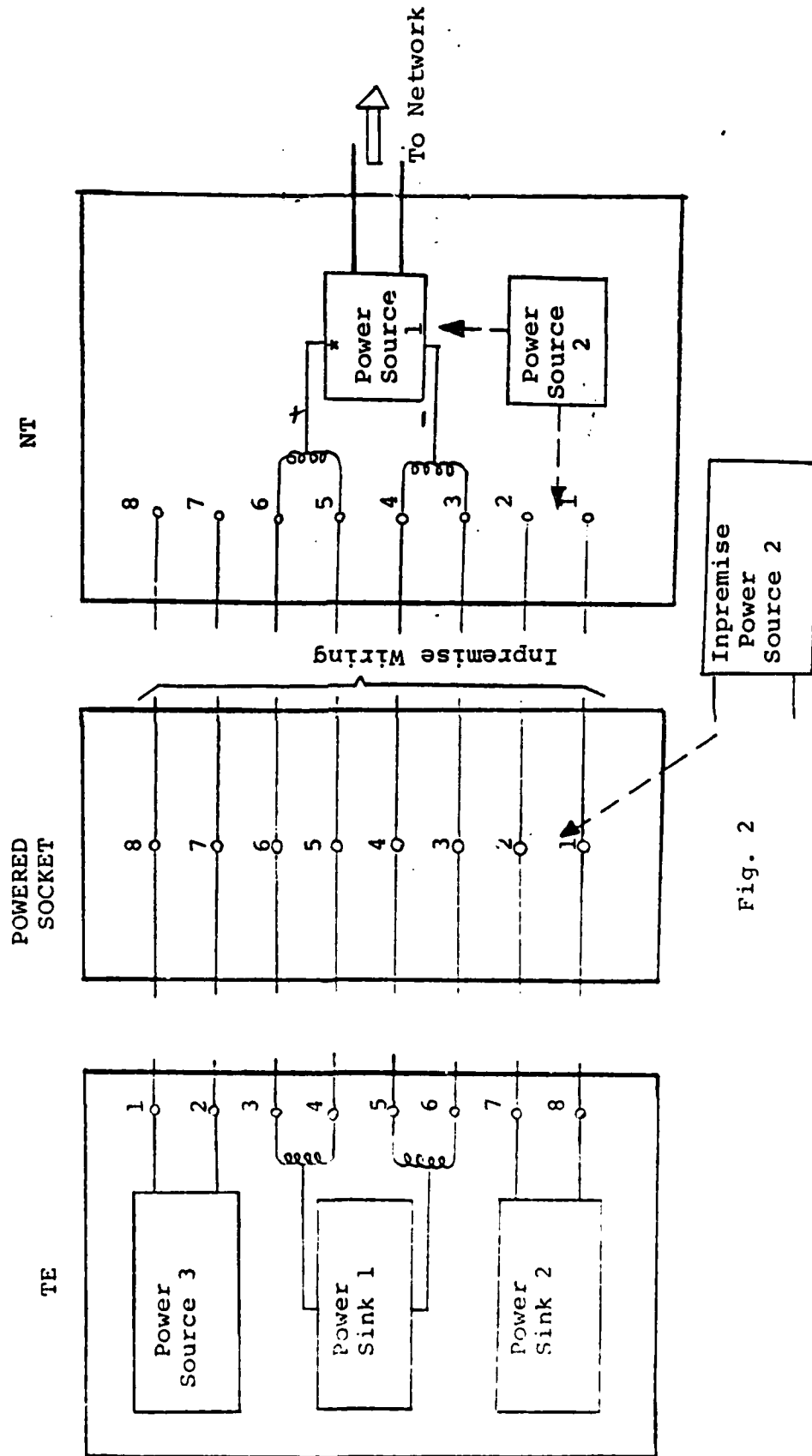


Fig. 2

TE to NT including use of powered socket

APPLICATION 2

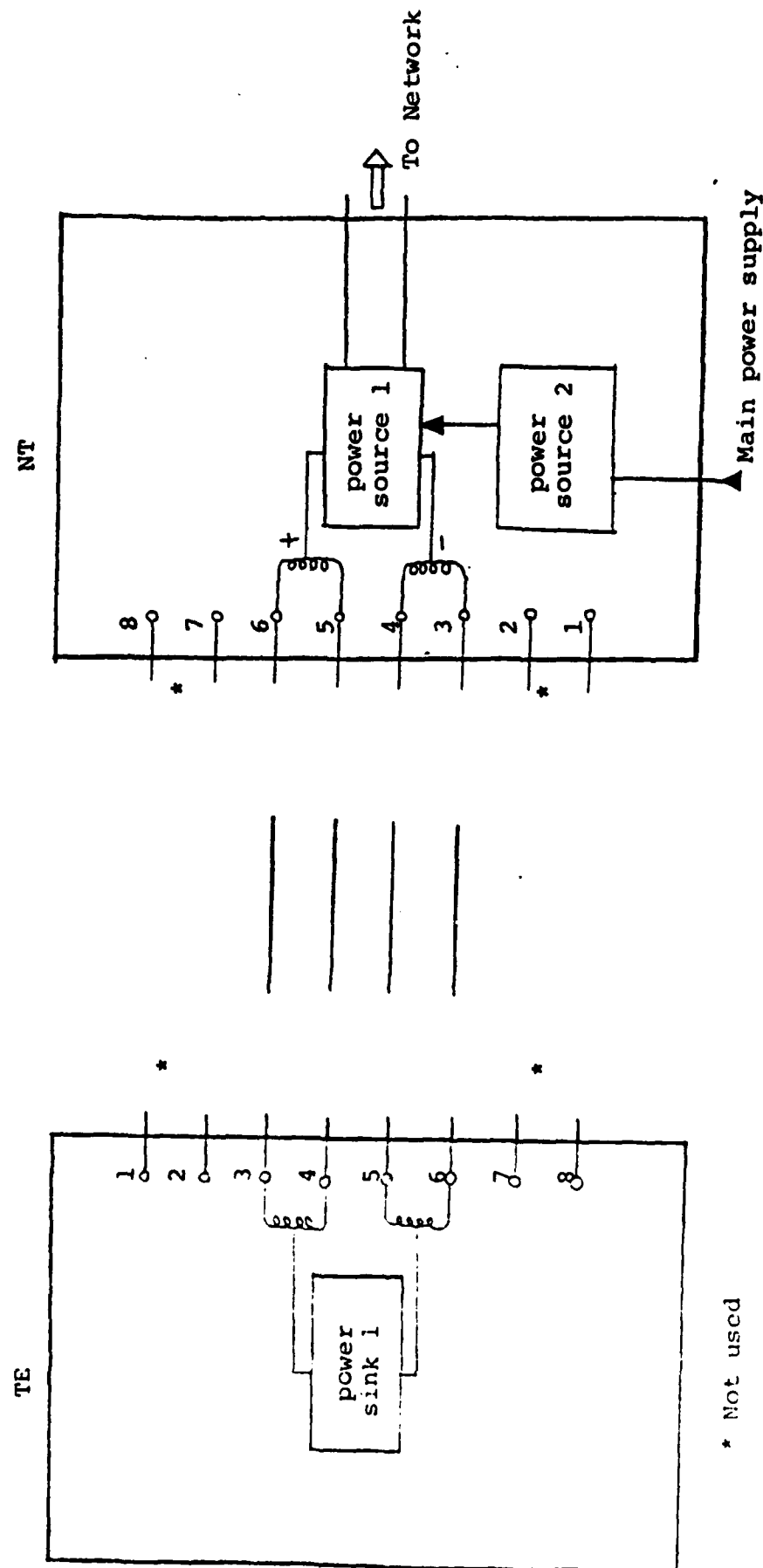


Fig. 3

TE to NT

Excluding use of powered socket

ii) As a consequence of point i, maximum value of power P_B has to be specified for power sink 1. Such a parameter corresponds to the maximum power extracted from the phantom leads (3 - 6) for some terminal capabilities (e.g. for "the minimum service"). Due to the maximum loss on 1 km of wires between NT and T P2 might be 240mW.

- b) Feature 2 Minimum power P_Y is available from source 1 when mains power and/or power resources provides to the NT by the telecommunications network are available. In some cases such a parameter P_Y should also be considered as a maximum. P_Y might be in the range of 0.5W to 2W and the final value is for further study. It was agreed that the powers P_A , P_B and P_Y should be specified.

3.2. Voltages and currents allocation

A general discussion about voltages and current allocation has occurred. Whether power source 1 has to be specified as a current or voltage source is for further study. A voltage of 40V was considered appropriate when power source 1 is supplied as a voltage source. This value requires further consideration at the next June meeting. If power is supplied by the exchange this may imply a DC-DC conversion within NT1. Due to safety considerations in the subscriber premises it may be necessary to limit the maximum values of currents and/or voltages on the phantom leads or on additional leads 1-2.

In application 1, some specific overvoltages specifications should also be required due to the possibility to connect NT to both sources of power (Telecommunication network and mains). A minimum isolation voltage between these two access has to be specified.

It was proposed that CCITT COM V should be requested to provide input on this problem.

4. General considerations

- 1) If an NT2 has more than one output port for terminal equipment connection (point to point), the provision of power to any port shall be optional. (This may be either administration or user option depending upon ownership.) An NT2 may receive power from an NT1 over the phantom, however, the sink at the NT2 will only be eligible for the same power as provided to TE's directly connected to the NT1 port (i.e. in a bus arrangement).
- 2) As a result of the previous paragraphs, it was agreed when the power source 1 is provided, that for terminal(s) allowed for "a minimum service" a power of (240-250mw) is available for both applications 1 and 2 described in Fig. 2 and 3.
- 3) Specification of two different P_A and P_Y for the minimum power to be supplied by source 1 has certain implications of terminal portability. Terminals that have no

alternate power source than source 1 in feature 1 or feature 2 will be portable only if their own maximum power consumption is less than specified in feature 1 described in par.3. Terminals that are designed to consume more power from source 1 as described of par. 3 in feature 2 described in par.3. must be provided with an alternate source (e.g. power source 2) if they have to be portable even feature 1 situation.

- 4) Terminal portability may also be limited by the provision of options for power feeding unless the terminals are designed to take power from all of the designated sources. In such a case it is necessary that "minimal operational capability" be provided by power from either the phantom or terminals access lead 7 and 8. Both sources should not be required to be present for this capability.
- 5) Supplementary power may be required by a terminal for providing additional features, above minimum capability. This supplementary power may be provided by the phantom or from terminals (Access leads 7-8). Supplementary power may optionally be provided from an individual power source.
- 6) A terminal may be arranged to operate only, from an individual power source (battery or mains). Specification of such a source is not a function of these recommendations.
- 7) Some Administrations have requested consideration of a back-to-back arrangement of TE-Such an arrangement is shown in Fig. 4.
- 8) Further studies are required in order to define
 - the minimum service
 - the "reference configuration in case of emergency"

(eg. The maximum number of sets for such a "minimum service" for both passive and active bus.)

 - the basic protocol for power feeding from NT when the overall power needed by terminals is greater than the power sent by NT in emergency situations. In such a situation the terminal should be designed in order to avoid any dedicated allocation in the subscriber's premises.

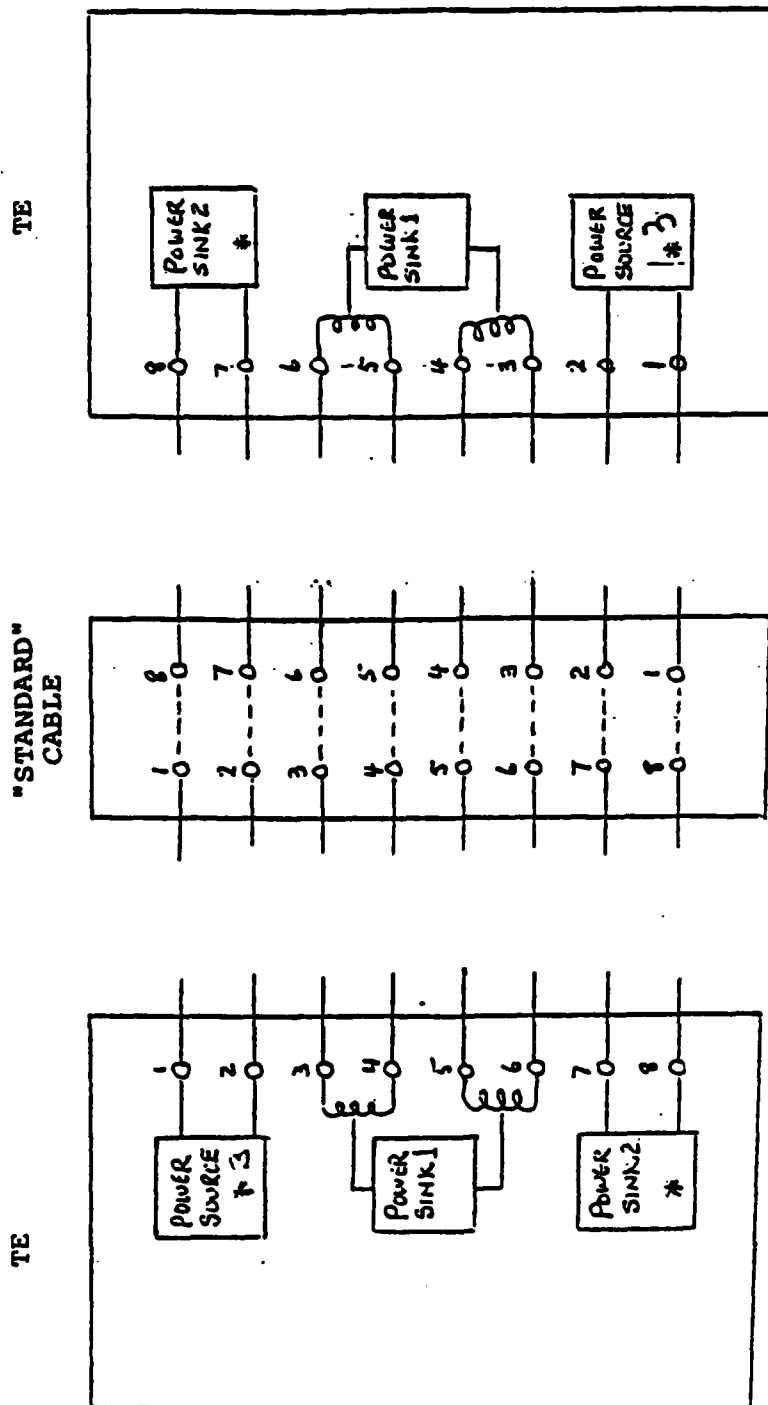


FIG 4 TE to TE with "STANDARD" CABLE CONNECTION

ANNEX 4

(to the report of Working Team 2)

DRAFT REC. 1130

Basic user/network interface - Layer 1 specification

1. General
 - 1.1 Introduction
 - 1.2 Scope and field of application
2. Types of Configuration
 - 2.1 Point-to-point
 - 2.2 Point-to-multipoint
3. Functional characteristics
 - 3.1 Summary of functions
 - 3.2 Interchange circuits
 - 3.3 Frame structure
 - 3.3.1 Bit rate
 - 3.3.2 Binary organization of the frame
 - 3.3.2.1 From TE to NT
 - 3.3.2.2 From NT to TE
 - 3.3.2.3 Relative bit position
 - 3.4 Line code
 - 3.5 Timing considerations
 4. Interface procedures
 - 4.1 D-channel access control
 - 4.1.1 Inter Frame Time Fill
 - 4.1.2 D-echo channel
 - 4.1.3 D-channel sensing
 - 4.1.4 Collision detection
 - 4.1.5 Successful frame transmission
 - 4.1.6 Priority mechanism

Layer 2

- 4.2 Activation procedure (including plug-in)
- 4.3 Deactivation procedure
- 4.4 Maintenance procedures (test loops, etc.)
- 4.5 Frame alignment procedure

- 5. Electrical characteristics
 - 5.1 Transmitter output characteristics
 - 5.2 Receiver input characteristics
 - 5.3 Timing characteristics
 - 5.4 Environmental characteristics (operating and protection level)
 - 5.4.1 Galvanic isolation
 - 5.4.2 EMI

- 6. Power feeding
 - 6.1 Reference configuration
 - 6.2 Power levels available NT
 - 6.3 Power levels available at TE

- 7. Mechanical characteristics
 - 7.1 Connector
 - 7.2 Pin assignment

Appendix 1

Interconnecting media characteristics

- 1. GENERAL to be drafted
In the following NT will be used to indicate arrangements of NT1 and NT2 and TE will be used to indicate either TE1 or TA.
- 1.1 Introduction to be drafted

- 1.2 Scope and field of application to be drafted

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2 TYPES OF CONFIGURATION

The following types of configuration apply only to the layer 1 characteristics of the interface and do not imply any constraints on modes of operation at higher layers. The interface characteristics specified in the following sections are generally intended to accomodate the configurations described in 2.1 and 2.2.

2.1 Point-to-point

Point-to-point configuration at layer 1 implies that only one source (transmitter) and one sink (receiver) are the connected to interface.

The maximum range of the interface in the point-to-point configuration could be limited by the maximum allowable system attenuation between NT and TE 1. It is proposed that this attenuation should not exceed 10 dB at 100 kHz.

Note The value of 10dB is for futher study; the objective is a reach of 1km on commonly available cables.

2.2 Point-to-multipoint

Point-to-multipoint configuration at layer 1 allows more than one source and more than one sink to be connected to and simultaneously active on a distribution system at S or T reference point. Such distribution systems are characterised by the fact that they contain no active logic elements performing functions (other than possibly amplification or regeneration of the signal.)

A typical configuration (passive bus) is shown in Fig. 1b). The maximum length of the passive bus could be limited by the maximum allowable round trip delay time and the length of any cable connecting a terminal to the bus.

It is proposed, that the maximum allowable round trip delay should not exceed 2.5 μ s and the length of these connecting cables sould not exceed 10 meters.

The electrical characteristics should be specified in such a way, that it should be possible to directly connect up to 8 terminals in the typical passive bus configuration.

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3. FUNCTIONAL CHARACTERISTICS

3.1 Summary of functions

B-Channel

This function provides for the bi-directional transmission of the two independent B-channels/each having a bit rate of 64 Kbit/s as defined in Recommendation Ixxy.

f(B1 and B2)

Bit Timing

This function provides bit (Signal Element) timing to enable the terminal or NT to recover information from the aggregate bit stream.

Octet Timing

This function provides 8 kHz octet timing towards the terminal or NT primarily for the purpose of enabling correct operation of PCM voice encoders but which may be used for other purposes as required.

Frame Alignment

This function provides information to enable the terminal or NT to recover the time division multiplexed channels.

D-Channel

This function provides for the bi-directional transmission of one D-channel at a bit rate of 16 kbit/s as defined in Recommendation Ixxy.

D-Channel Access Control

This function is specified to enable terminals to gain access to the common resource of the D-channel in an orderly, controlled fashion.

End Point Deactivation

This function is specified in order to permit terminals and NT equipment to be placed in a low power consumption mode when no calls are in progress. The procedures and precise conditions under which such deactivation takes place are for further study.

End Point Activation

This function allows the terminal or NT to be restored to its normal-operating power mode. The procedures and precise conditions under which such activation takes place are for further study. After the completion of the activation procedure level 1 is considered to be ready for use.

Maintenance

The definition and use of these functions are for further study. ...

Power Feeding

As a principle power transfer through the interface shall be possible. The typical application is telephony to ensure emergency service.

3.2 Interchange circuits

Two interchange circuits, ^{one} for each direction are used for the transmission of digital signal. All the functions above listed, with the possible exceptions of power feeding (see par.6) are combined on a multiplex digital signal with a frame structure described below.

3.3 Frame Structure

In both directions ^{of transmission} data are grouped into frames of 48 bits each. The frame structure is identical for both point-to-point and point-to-multipoint configurations (passive bus configuration). Each frame consists of several groups of bits. *Unused spare bits are set to binary 0.*

3.3.1 Bitrate

The nominal transmitted bitrate at the interface is 192 kbits per second. According to the frame structure of 48 bits per frame the nominal frame duration is 250 microseconds.

The ^{actual} bitrate is determined by the network clock frequency.

3.3.2 Binary Organization of the Frame

The frame layout is shown in figure 2.

3.3.2.1 Terminal to Network

Each frame consists of the following groups of bits; Each individual group is DC-balanced by the means of an trailing balance bit (L-bit):

- framing signal
- B1-channel
- D-channel bit
- Auxiliary framing bit/spare bit
- B2-channel
- D-channel bit
- B1-channel
- D-channel bit
- B2-channel
- D-channel bit

3.3.2.2 Network to Terminal

Frames transmitted by the network (NT) contain an echo-channel (E-bits) used to re-transmit the D-bits received from the terminals. The D-echo-channel is used for *D-channel access control*. The last bit of the frame (L-bit) is used for balancing each complete frame.

The following groups of bits are identified:

- framing signal
- B1-channel
- E-channel bit
- D-channel bit
- Spare bit 1
- Auxiliary framing bit
- B2-channel
- E-channel bit
- Spare bit 2
- D-channel bit
- Spare bit 3
- B1-channel
- E-channel bit
- D-channel bit
- Spare bit 4
- B2-channel
- E-channel bit
- D-channel bit

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3.3.2.3. Relative Bit Positions

At the terminals the timing signals derived from the received frames are used as transmit timing.

The beginning of each frame transmitted from a terminal towards the network is delayed by two bits with respect to the beginning of received frames. Figure (2) shows the relative bit position for both transmitted and received frames.

3.4 Line Code

For both directions of transmission pseudo-ternary coding is used with 100% pulsewidth as shown in fig. 3. Coding is done in such a way that a binary one is represented by no-line signal whereas a binary zero is represented by alternative positive and negative pulses. The first binary zero following the framing signal is always negative. The framing signal always starts with a positive pulse. In the direction from the terminals to the NT the first binary zero of each group of bits is always negative, except for the framing signal.

3.5 Timing considerations

The NT derives its timing from the network clock. The TE synchronizes its timing (bit, octet, framing) from the signal received from the NT and synchronizes accordingly its transmitted signal.

4. Interface procedures

4 .1 D-channel Access Control

The following procedure allows for a number of terminals connected in layer 1 configurations described above to gain access to the D-channel in an orderly fashion. The procedure ensures that, even in cases where two or more terminals attempt to access the D-channel simultaneously one terminal will always be successful in completing transmission of its information.

4. .1.1 Layer 2 Inter Frame Time Fill

Information on the D-channel is contained in layer 2 frames delimited by flags consisting of the binary pattern 01111110. When no terminal has information to transmit the condition on the interface shall consist of binary all "ones" in the direction towards the network. This is required for the operation of the D-channel access coded procedure. The interface condition in the direction from the NT requires further study.

4. .1.2 D-echo channel

NT on receipt of a D-channel bit from TE shall reflect this condition in the next available D-echo channel bit towards the terminal(s).

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4. .1.3 D-channel sensing

A terminal which requires to transmit information on the D-channel shall monitor the condition on the D-echo-channel. A terminal is allowed to start transmission of a layer 2 frame at any time after a sequence of consecutive binary ones is counted equal to or greater than a preset value X. Detecting a binary zero will reset the counter.

4. .1.3 Collision Detection

While transmitting information in the D-channel the terminal shall monitor the received D-echo channel and compare the last transmitted bit with the next available D-echo bit. If the transmitted bit is the same as the received echo, the terminal shall continue its transmission. If, however, the received echo is different to the transmitted bit the terminal shall cease transmission immediately and return to the D-channel sensing state.

4.1.5 Successful Layer 2 Frame Transmission

A terminal which has successfully completed the transmission of a layer 2 frame shall adjust its present value from X to 'x+1' and return to the sensing state. This preset value shall be maintained in this condition until 'x+1' D-Channel 'ones' have been detected on the consecutive binary D-echo channel.

4.1.6 Priority mechanism

The value of the counter 'x' shall be preset on manufacture of installation. In other cases the value shall be under the control of higher layer functions (e.g., in the case of a multifunction terminal). Control of the priority level will be communication by means of a primitive passing down from the higher layers. It is recommended that two values of 'x'

X=8 and X=10 should be provided.

4.2 Activation procedure

to be drafted on the basis of Annex 2 of the report of working team 2.

4.3 Deactivation procedure

to be drafted on the basis of Annex 2 of the Report of working team 2.

4.4 Maintenance procedure

for further study.

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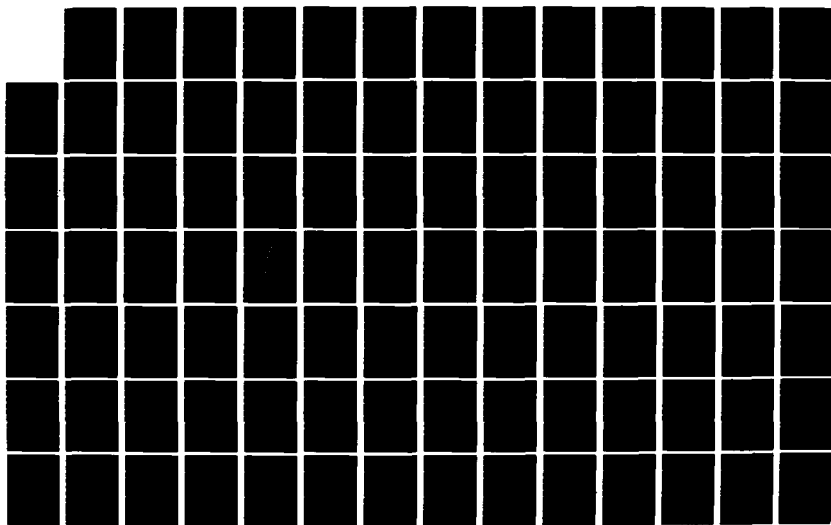
REPORT OF THE INTERNATIONAL TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE (U) NATIONAL COMMUNICATIONS
SYSTEM WASHINGTON DC FEB 83 NCS-TIB-83-1

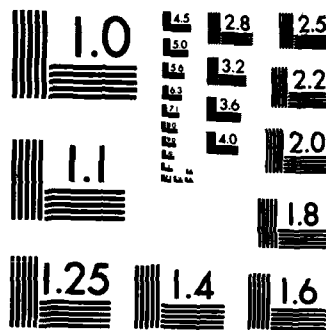
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MICROCOPY RESOLUTION TEST CHART
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4.5 Frame Alignment Procedure

The frame alignment procedure makes use of violations and thereby allows fast frame synchronization.

According to the coding rule the framing signal produces a violation of the alternate polarity rule and the next "binary zero in the same multiframe" also causes such a violation. If no "binary zeros" are transmitted the last mentioned violation results from the auxiliary framing bit position (FA) which is coded as a binary "zero" and occurs 13 bit positions after the framing signal.

4.5.1 Framing in the NT to TE direction

The terminal is looking for a first violation. Having detected a violation it starts counting the received bits until it detects a further violation. If the contents of the counter is less or equal to the value 13 (distance between framing bit and auxiliary framing bit) the terminal has detected the right framing. If the contents of the counter is greater then 13 it may not have chosen the right framing bit and restarts the search process.

Because the direction of the violation is to no significance the procedure is not depending on the polarity of the received signal, therefore, a line inversion does not affect the framing.

4.5.2 Framing in the TE to NT direction

The same procedure as in the NT to TE directions applies. It should be noted however, that the framing procedure at the NT may be discarded (fixed receiver timing) in case of short passive bus length or simplified.

4.5.3 Multiframeing

Multiframeing may be achieved by using a specific bit pattern for the auxiliary framing bit (FA).

In the NT to TE direction the first frame of multiframe structure is identified by FA set to binary "one" followed by $n-1$ frames with the FA-bit set to binary "zero". With $n=4$ this procedure allows exact framing after 4 frames.

In the TE to NT direction the first frame of a multiframe structure is identified by FA set to binary "zero" within every n -th frame (statistical multiframeing). Within the remaining $n-1$ frames this bit is identified as a space bit and present to binary "one" as long as unused. It should be noted, that for the reason of determined time relationship between a frame transmitted and a frame received by the NT, the multiframe structure can easily be maintained.

Note: In the case of a TE to TE connection which is out of the scope of this recommendation some restrictions are put on the use of the recommendation.

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5. ELECTRICAL CHARACTERISTICS

to be drafted

6. POWER FEEDING

6.1 Reference Configuration

The reference configuration for power feeding based on a 8 pins interface connector is described in Fig. 4. The use of 4 access lead (3, 4, 5, 6) is mandatory, the use of the remaining 4 (1, 2, 7, 8) is optional.

The reference configuration allows unique physical and electrical characteristics, for the interface at reference points S and T, which are independent of the choice of internal or external power sources arrangements.

Power source 1 may derive its power from the network and/or locally (including batteries) - Power source 2 derives its power locally (including batteries).

6.1.1 Functions specified at the 8 access leads.

The 8 access leads, for TE and NT should be applied as follows:

a) Access leads 3-4 and 5-6, whose provision is optional are strictly reserved for the bidirectional transmission of the digital signal and may provide a phantom circuit for power transfer.

b) Access leads 1-2 and 7-8, whose provision is optional may be used for additional power transfer from NT to TE.

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c) Access leads 1-2 and 7-8, whose provision is optional, may be used for power transfer in TE-TE interconnection. This is not subject of CCITT Recommendation.

Note 1 Power source 2 - Provision of this source is subject to the decision of individual administration.

Note 2 Where the power source 1 is provided, a minimum and a maximum power available from this source on the phantom will be specified.

Note 3 Power sink 2 is optional.

Note 4 Power source 3 is not subject to CCITT Recommendation.

Note 5 Power sink 1 is optional. Administrations may limit the use of the power from the phantom to those terminals of providing a minimum service.

Note 6 The numbering of leads in Fig. 4 does not imply any assumption on allocation on physical connection.

Note 7 Maintenance of polarity on a wired pair cannot be guaranteed in all cases. This must be taken into consideration for terminals drawing power from 7-8 access leads.

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6.2 Power levels available from NT.

Two different situations are identified relative to power feeding.

a) Minimum power, P_x , available from source 1 on the phantom (e.g. when main powering is unavailable or not provided at the NT). The value P_x should be 250mw. This may be the only available power in case of emergency.

b) Minimum power, P_y , available from source 1 on the phantom using local main power or an equivalent level of power from the network (or a combination of local and network power). The provision of power greater than P_y will be the responsibility of individual administrations. P_y should be in the range of 0.5W to 2W, final value is for further study.

Note 1 Whether the power source is provided as voltage or current source is for further study.

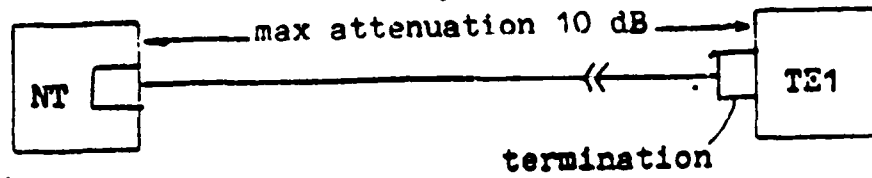
Note 2 A nominal voltage of 40V was considered appropriate when power source 1 is supplied as a voltage source. If power source 1 is supplied as a current source, the maximum voltage is for further study.

6.3 Power levels available at TE.

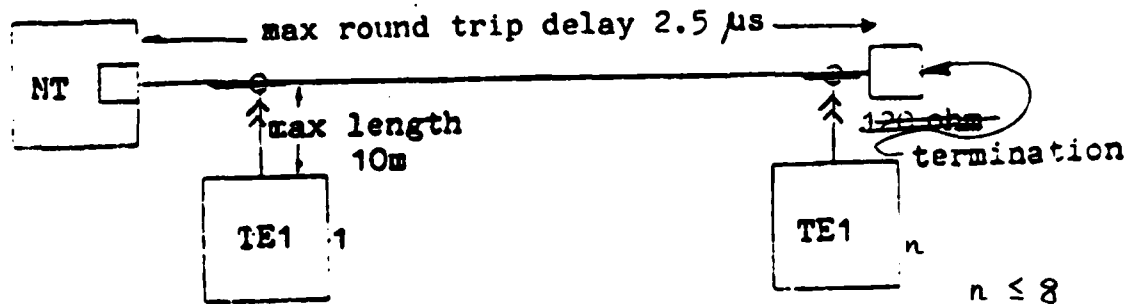
The value of power, P_g , extracted by the TE from the phantom on access leads 3-4 and 5-6 for some terminal capabilities (e.g. for a minimum service) should be 240 MW.

Note The final values of P_x , P_g and P_y have to be determined.

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1a) point-to-point configuration



1b) point-to-multipoint configuration (passive bus)

Fig. 1 Reference configurations

...

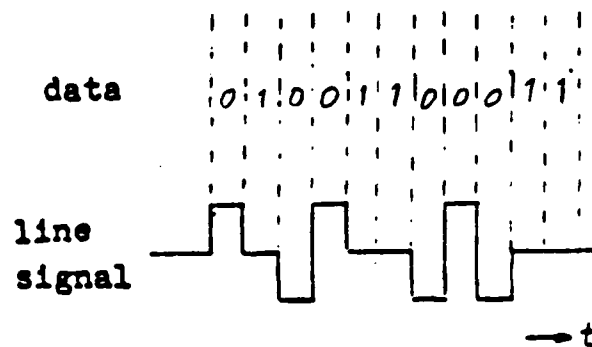


Fig. 3 Pseudo-Ternary-code
Example of application

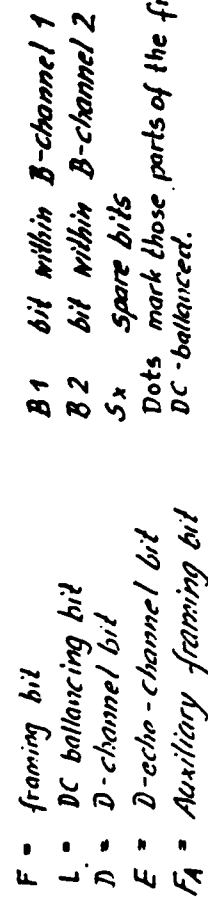


Figure 2: Frame structure at reference points S and T

Reference Configuration for Power Feeding

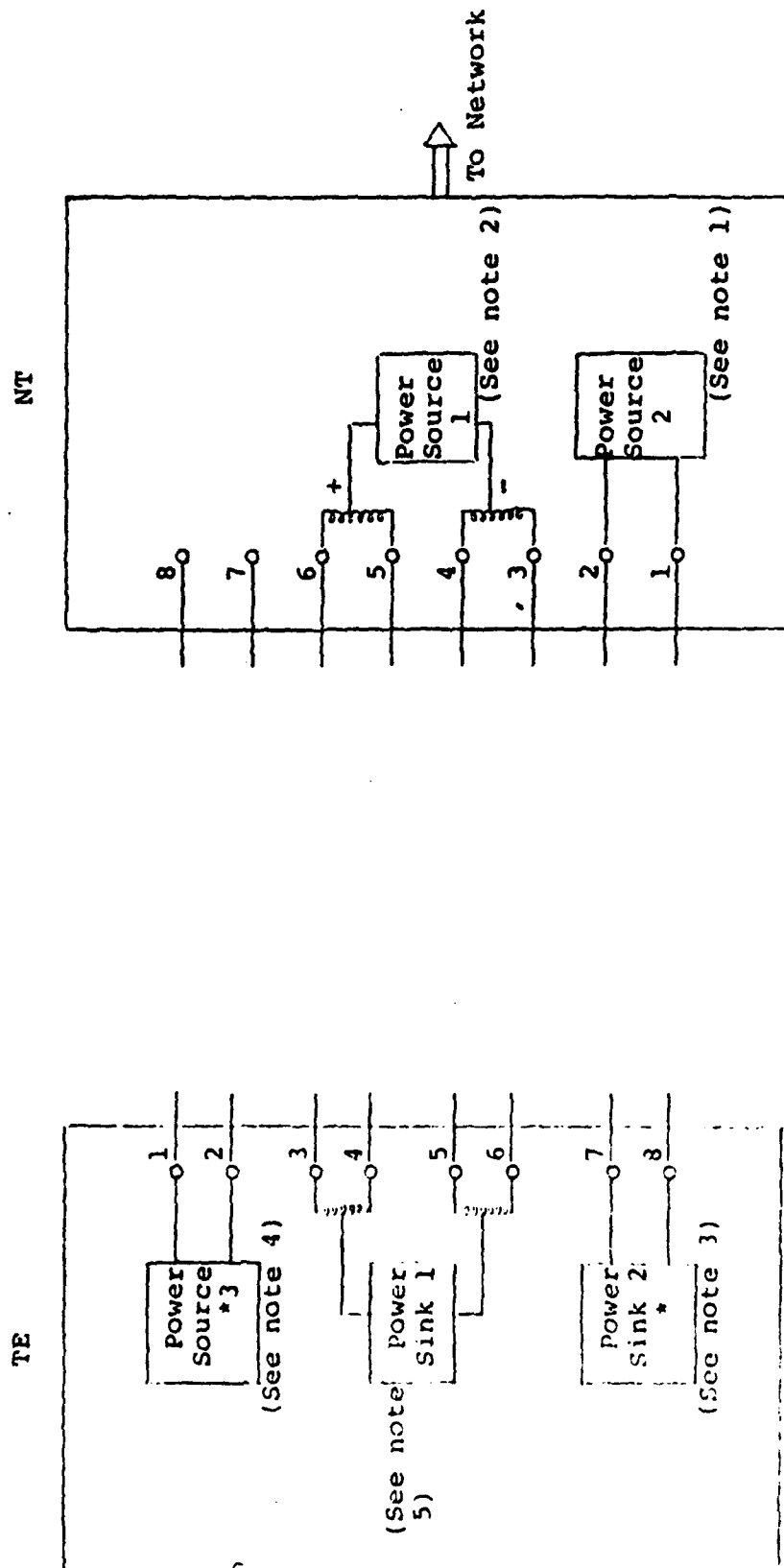


Fig. 4

C.C.I.T.T.

Study Group XVIII

(Group of experts on ISDN matters)

Kyoto, 14-25 February 1983

SOURCE : CHAIRMAN - WORKING TEAM 3 - NETWORK

TITLE : REPORT OF WORKING TEAM 3 - ISDN NETWORK ASPECTS

1. INTRODUCTION

The terms of reference for Working Team 3 were to consider all network aspects of the ISDN, namely those aspects covered by Question 1/XVIII points B, D and E.

The work was based on the Munich report COM XVIII/R8 and on the encouraging number of contributions which have focussed on the key network issues identified as a result of the earlier work. In addition, contributions and requests from other Study Groups have opened up further key issues for initiation of study at Kyoto.

2. RELATIONSHIP TO PREVIOUS WORK

The previous work documented in COM XVIII/R8 subdivided the work into, Connection types, Network addressing, ISDN HRX, ISDN Protocol reference model and ISDN Architecture functional model.

These subdivisions were retained for Kyoto. As a result of the contributions received and interactions with other Study Groups the following additional subdivisions were also subject of work at Kyoto; Routing, tariff, maintenance principles, internetworking interfaces and ISDN evolution.

3. REVIEW OF DOCUMENTS

A brief review of all the documents considered by the working team is given in Annex 1.

4. STRUCTURE OF WORK AT KYOTO

The subdivisions of work for Kyoto and the documents relevant to each are shown below. The work plan for the meeting is given in TD15.

4.1 Sub divisions Continued from Munich (COM XVIII/R8)

- (a) Connection types - Whites 140(FRG), 149(Canada-BNR), 151(Sweden), Delayed, GZ(FRG), HA(FRG), HG(FRG), HH(FRG), IH(FRG), IK(USA), IL(USA), IM(USA), JO(Canada-TCTS) TD1(WP XI/4)
- (b) ISDN Architecture Functional Models - 130(USA), IA(France), JJ(Canada), JF(Canada-Teleglobe)
- (c) Network addressing - IF(France), JA(KDD), ID(France), IH(FRG), JE(Canada-BNR), JL(Canada), TD425(SGVII), TD19(LIASON RAPP SGVII/SGXVIII)
- (d) ISDN Protocol Reference Model - 138(SGXVI), 149(Canada-BNR), HG(FRG), HI(FRG), HQ(NTT), HR(NTT), IH(FRG), IO(USA), IT(Canada-BNR), TD1(WPXI/4), TD8(WPXI/5), TD12(Q3/XI) JB(KDD), JP(Canada-TCTS), JY(Australia), KB(Australia), KT(BT), JC(KDD), TD2(XI/6)
- (e) ISDN HRX - IX(COMSAT), JD(KDD), TD10(CCIR)

4.2 Additional Sub divisions for KYOTO

- (a) Routing - 135(SGII), 136(SGII), TD5(SGVII)
- (b) ISDN Evolution - IB(France), JW(Australia)
- (c) ISDN Maintenance Philosophy - 148(SWEDEN), HD(ECMA), HK(ISO), HU(NTT), TD2(SGX I), TD7(SGVII), JS(SWEDEN)
- (d) Internetworking interfaces - TD6(SGVII), TD12(Q3/XI), JR(SWEDEN)
- (e) Tariff - 129(SGIII), TD11(SGIII)

5. DRAFT RECOMMENDATIONS PREPARED

The following draft recommendations were prepared as described in the body of this report.

- I 021X - Network Connection Types - Refer Annex 2. ~~(TD45)~~
Drafting group chairman - J.C. Lutchford (Canada - BNR)
- I 0210 - ISDN Architecture Functional Model - Refer Annex 3 ~~(TD44)~~
Drafting group chairman - A. Roche (France)
- I 0310 - ISDN Numbering and Addressing Principles - Refer Annex 4 ~~(TD47)~~
Drafting group chairman - E. Space (USA)
- I 0220 - ISDN Protocol Reference Model - Refer Annex 5 ~~(TD46)~~
Drafting group chairman - N.DUC (Australia)

6. CONNECTION TYPES

As a result of the close correlation between network connection types and services definition, the two subjects were considered together in a joint WT3/WT4 meeting chaired by Mr. Pfyffer (Switzerland). The work in the joint meeting resulted in the preparation of draft recommendations on ISDN Services and on ISDN Network Connection types. The draft recommendation on Network Connection types was subsequently considered in detail by the WT3 (Network) group. The approved version of the text is included as Annex 2.

The Services recommendation was considered by WT4. With respect to n x 64 kbit/s connections, "S.G. XVIII endorses the view expressed by WP XI/4 in Annex 4 (part) of Part II of COM SX.R19. The views expressed by WP XI/4 are fully consistent with the decision included in COM XVIII/R8 pages 64-65. In addition SGXVIII draw the attention of SGXI to draft Recommendation ~~check number~~ network connection types."

7. ISDN Architecture Functional Model

The documents considered are identified in paragraph 4.

It was agreed that sufficient material was available based on COM XVIII/R8 and contributions to KYOTO, to initiate a draft recommendation on ISDN architecture functional model.

The objective for a draft recommendation was to provide a common understanding of the ISDN architecture functional model to assist the study on specifying the characteristics that appear at user/network and inter-working interfaces. For example, protocol, network performance (e.g. HRX), network routing, tariff etc. Characteristics in the model should not preclude or inhibit any national implementation and should be considered to be examples.

It was agreed that the draft recommendation should be prepared in two parts.

- (a) Outline a conceptual view of the ISDN. This would pull together the various draft recommendations proposed and identify their network relationship. The basic routing rules and interworking rules would be included if possible. It would also develop a functional architecture which is independent of implementation arrangements. This section could be based on document JJ(Canada) with document JJ(France) used for the introduction.
- (b) An example of how the needs of the functional model may be met. The recommendation should be independent of physical architecture. The example(s) would be for information only and to encourage further contributions to develop the functional model in section (a). It was agreed that document JJ(France) could be used as a basis for drafting.

A drafting group was set up under the chairmanship of Mr. J. J. (France) to prepare a draft recommendation. The draft recommendation, ISDN Architecture Functional Model is included as Annex 3. *Annex 3 of annex 3.*

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The working team succeeded in establishing a first version of a Recommendation which is divided in two parts:

- functional model,
- architectural model

It was understood that this Recommendation should not imply or preclude any type of implementation. This objective should be kept in mind when further improvements of the draft text are undertaken. The draft Recommendation is attached as Appendix 1 of this Report.

The Working Team was of the opinion that this Recommendation should be placed before the Recommendations dealing with protocols models and HRX's and therefore proposes to number it I0210.

During the discussion, the working team was not able to find a satisfactory definition for the "target ISDN". This concept was therefore given up.

The W.T. noted that - in some countries - a customer network may be connected to more than one local network and possibly more than one transit network. However, note was also taken of the following statement, contained in D.C. JF from Canada.

"An unrestricted capability for user selection could result in some end-to-end connections with "round-about" routings not envisaged in network management arrangements and not necessarily meeting CCITT Recommended service criteria. To avoid potential difficulties of this type another general principle is needed as follows:

If a user is to be permitted selection of international routes, this selection must be restricted to the alternative combination of routes, services and characteristics between originating and terminating countries as bilaterally agreed between the concerned Administrations (in consultation with their RPOA)".

It was also noted that the definitions of "reference configurations", "functional grouping", "reference points" (see Annex 1 - Part B, section 1) were basically identical to the corresponding definitions settled by draft Rec. IXXX. It was agreed that these definitions should be further shifted out both Recommendations I 0210 and IXXX and inserted in a separate Recommendation applying to the overall 1 series.

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8. NETWORK ADDRESSING

The contributions are identified in paragraph 4

It was agreed that guidance on numbering and addressing principles for the ISDN are urgently needed to help progress the work in other Study Groups. It is not the task of SGXVIII to prepare a numbering plan; this task is the responsibility of Study Group II who do however require the advice of Study Group XVIII on the requirement of ISDN numbering and addressing principles.

It was agreed that sufficient material was presented to the meeting, together with the studies already documented in COM XVIII/R8, to prepare a draft recommendation on Numbering & Addressing Principles for the ISDN. The following were identified as the key issues on which the views of SGXVIII should be expressed in the draft recommendation:-

- (a) Digit System i.e. base 10, base 12, base 16 etc.
- (b) Separate routing information from address information
- (c) Application and definition of Service Indication Code(SIC)
- (d) Access to services as well as terminal addressing
- (e) Interworking with private networks
- (f) Interworking with dedicated networks
- (g) Identify and define sub-addressing needs
- (h) Addressing for multi function terminals e.g. Single directory number followed by SIC or alternatively multiple directory numbers.
- (i) Identify at which point in the address does network responsibility terminate and charging commence.

It was agreed that the draft recommendation would :-

- follow OSI Layering Principles where possible and would focus on the Layer 3 addressing.
- concentrate on the terminal/network aspects rather than the user/terminal human interface.

A drafting group was set up under the chairmanship of Mr. Spar USA to prepare a draft recommendation..

The preliminary draft recommendation, Numbering and Addressing principles in the ISDN is included as Annex 4.

Administrations and other Study Groups are requested to provide comments on the draft so that views may be filmed up in the recommendation before the end of the current study period.

9. ISDN PROTOCOL REFERENCE MODEL

Contributions are identified in paragraph 4.

The need for a protocol reference model was confirmed as essential input to signalling design work, network control, signalling performance, addressing etc.

Discussion of the many contributions received indicated two stages to the work.

- (a) Development of an overall protocol reference model. This model to be tested against a number of specific examples such as connection types.
- (b) Iteration of the many network control functions identified with the basic model to include more detailed results.

Following detailed discussions on the contributions it was agreed that a preliminary draft recommendation on the overall protocol reference model could be drafted. Potential differences between the protocols as seen at the user/network interface and the protocols as seen within the network were identified.

It was agreed that document KB(Australia) together with COMXVIII/R8 and other inputs could be used as the basis for the draft recommendation.

A drafting group was set up under the chairmanship of Mr. Duc (Australia). It was agreed that the work of the drafting group in preparing a draft recommendation on ISDN Protocol reference model should focus on :-

- (a) Data Protocols - the integrity of layers 1-7 would probably be maintained across the network.
- (b) Signalling protocols were subdivided into
 - (i) Transmission of address informations : in this case a potential discontinuity between layers 3 and 7 exists between access and network signalling.
 - (ii) Routing of address information through the signalling network : expected to maintain the integrity of layer 3.
 - (iii) Network control information : Study is needed to determine the impact on the integrity of layers across the network.
- (c) Transmission of end user to end user information.
- (d) Testing of the basic model by application of as many connection types as possible.

The resulting draft recommendation is included in Annex 5.

It was agreed that the network control functions should be iterated with the model developed in Annex 5 as a next step. To initiate this process a list of the control functions identified ~~to date is also included in Annex 5,~~ *in the contributions will be prepared by the rapporteurs for input to the June meeting in Geneva, 1983.* Administrations and other study groups are requested to take note of the procedures and submit contributions to progress the work at the June 1983 meeting of SGXVIII.

10. ROUTING

Contributions are identified in para. 4. ~~and reviewed in Annex I.~~

The revision of the telephony routing plan recommendation E171 to E 17X by Study Group II was noted. Also that SG VII were revising recommendation X 110 to take account of the ISDN.

It was agreed that it was too early to provide definitive advice from SG XVIII on ISDN routing principles. The following action was recommended.

- (a) To forward draft recommendations I 0210-ISDN Functional Architecture Model and I 0310-ISDN Numbering and Addressing Principles to Study Groups II and VII to indicate the current views of SG XVIII.
- (b) To suggest to SGII that the current routing plan for telephony may not be sufficiently flexible for the ISDN. A copy of figure 1 (Page 3) TD 5 (Report of SG VII) should be forwarded to SG II as an indication of current routing problems encountered in data networks.
- (c) To indicate to SG II that in the view of SG XVIII, network routing is closely associated with numbering and addressing. It is the view of SG XVIII that numbering and addressing studies should have higher priority than routing.

A suggested reply to SG II is given in Annex 6.

11 ISDN EVOLUTION

The contributions are identified in para. 4 and reviewed in Annex 1. The difference between the ISDN Architecture functional model, which would include interworking arrangements leading to an ISDN, and a separate recommendation on ISDN evolution was discussed.

It was agreed that interworking questions as identified in document IA(France) would be included in the draft recommendation (I 0210) ISDN Architecture functional model.

It was also agreed however that principles of evolution need to be stated. Such principles may become subject of a new draft recommendation on ISDN evolution.

It was agreed that the principles given in document JW(Australia) could form the basis for a preliminary set of evolutionary principles, in addition to these already included in recommendation I 0010 (ISONS). D

After some discussion the first set of ISDN evolution principles were agreed as :-

- (a) As a telephony IDN evolves it will be enhanced by appropriate switching and signalling intelligence to provide a multi-services inter-exchange capability (i.e. a multi-services IDN).
- (b) Digital transmission will be established in the distribution network to provide digital customer access to service networks. Where technically and economically justified, integrated services access will be established.
- (c) Developmental steps will be checked for consistency with the ISDN concept. Wherever practicable, network enhancements will be based on internationally accepted standards for ISDN.
- (d) Existing and ~~possible~~ also new services will be supported by service-dedicated networks while these continue to provide efficient solutions.
- (e) Interworking with dedicated networks will be progressively established as appropriate to enable optimum usage of plant and effective penetration of services as an ISDN evolves.

- (f) ISDN access may also be used as a leased line access to allow a terminal to access a leased line or private network.

ISDN evolutionary principles should discriminate between those functions which must be included in the network from day 1 of an ISDN and those network functions which will be introduced progressively as an ISDN evolves. For example network support for the channel structures at ISDN interfaces may evolve from partial support to full support, possibly involving the use of hybrid access arrangements. In addition, network features, such as user/network signalling, may be provided initially in a limited way, and evolve towards full capability.

12. MAINTENANCE PHYLOSOPHY

The objective in considering maintenance under this question was to prepare some early maintenance philosophy on the ISDN as preliminary input to the study under question 12/XVIII. It was agreed that ongoing ISDN maintenance study would be carried out under question 12/XVIII. Question 1/XVIII would provide ISDN network inputs as required.

The importance of early consideration of maintenance issues for the ISDN was emphasized by the working team.

It was agreed to extract the ISDN maintenance objectives from COM XVIII/148 (Sweden) as follows -

The report of Working Party XI/6 - COM XI R17 - (TD 2) also contains relevant information but there was insufficient time to discuss ISDN Maintenance Objectives

~~Objectives~~

In order to try and meet the overall objective a number of subsidiary aims have been identified for the network:

- (a) To make the network highly reliable so that the number of failures occurring is low.
- (b) To incorporate where technically and economically feasible techniques that minimise the effect of failures on service.
- (c) To rapidly detect failures that effect service and to indicate them to the maintenance staff. The intention is to detect failures before the customer does, so that corrective action can be initiated in advance of the customer complaining. Also if the customer complains he can be advised that corrective action is already being taken.

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- (d) To incorporate facilities to enable the failure to be approximately located by the maintenance staff so that failure clearance is achievable by a single visit.
- (e) To provide an appropriate maintenance organisation and levels of staffing such as to achieve goals for out of service and repair times set by the administration.
- (f) To base as a first step the requirements on the use of a simple NT (only comprising level 1 functions), which leads to a basic set of requirements.
- (g) Intelligent NT's (e.g. PABX, LAN gateway) are not for this moment taken into consideration, but are for future consideration of additional sets of requirements.

Some of the more critical maintenance functions are identified in document JS(Sweden) the relevant facts of which are included as Annex 7.

Remote testing -

One of the more contentious maintenance issues, that of remote testing for ISDN customer terminal equipment was identified in documents HD(ECMA), HK(ISO), HU(NTT) and TD19.

After a lively discussion on the topics the following preliminary agreement was reached:-

- (a) Test loop back arrangements at the network side of the user/network interface ie. at NT1 or NT12, should be a mandatory requirement for ISDN network termination equipment.
- (b) Test loop back arrangements at the user side of the user/network interface ie. at TE, TA and possibly NT2, should be the subject of further study.
- (c) Activation of the test loop back arrangements at the network side of the user/network interface would be a layer 1 function; however, the control of test loop activation over the line transmission from the local exchange ie. how such control was to be effected eg. using house-keeping bits in the frame structure, was for further study.
- (d) The possible activation of the test loop back feature on the network side of the user/network interface by a user remotely via the network should be considered for further study. However, any such activation should only be permitted when under supervision of the network.

Note: In the event that remote activation of the test loop back feature is agreed, Study Group XI should be advised of the additional signalling requirement

- (e) The security aspects of remote activation of the test loop back feature on both sides of the user/network interface by users should be taken fully into account eg. to prevent unauthorised manipulation of both use and network equipment. Possibly, such remote activation should only be allowed while the user is in a data transfer phase.

13. ISDN - HYPOTHETICAL REFERENCE CONNECTION (HRX)

It was agreed that further development of the HRX for ISDN should be pursued under question 9/XVIII. As input to question 9/XVIII the meeting confirmed the preliminary information given in COMXVIII/R8 namely -

- (a) The HRX for the ISDN should take account of the network down to the ~~ST~~ interface reference point. *to be a*

(under question 1)

- (b) There may be a number of HRXs needed to cover mixed interworking between an ISDN and dedicated networks. *point.*

Additionally it was agreed that development of the ISDN - HRX should take account of the revised routing plan for telephony recommendation El7X and the revised routing plan for data recommendation X110.

Two contributions were also noted which introduced the concept of satellite equivalent distance (SED); this concept might be useful in the study of HRX for ISDNs.

It was agreed to monitor the ISDN-HRX progress and input any relevant ISDN network views as appropriate.

All documents considered at the meeting on this topic should also be submitted to question 9/XVIII for consideration at the Geneva meeting in June 83.

14. Internetworking Interfaces

The working team agreed that internetworking interfaces is likely to become one of the more urgent issues during the next few years. Major emphasis has focused to data on the user/network interface. There is growing recognition that network to network and network to vendor (which may also be a network) interfaces will become equally important.

Administrations are urged to submit further contributions, in particular to identify which internetworking interfaces (if any) should be subject to CCITT recommendations.

One contribution, JR(Sweden) identified two such potential internetworking interface issues. This contribution is included as Annex 8 and the attention of Study Group XVII and VII is drawn to this interworking issue.

15. TARIFF

The objective in considering tariff under question 1 was to identify a reply to SGIII as requested in COMXVIII/129.

It was agreed that two draft recommendations I0210 - ISDN Architecture functional Model and I0310 - ISDN Numbering and Addressing Principles be forwarded to SGIII for information.

16. CALL SUPERVISORY PRINCIPLES

There was insufficient time to study the full contents of the reapporteurs Report on question 3/XI (Report of Bournemouth [England] meeting). The following comments will respect to call supervisory tones are offered for consideration key WP XI/6.

Given the possibility of different call supervisory signals being presented to a caller at the human-machine interface depending on whether a call is totally intra-ISDN or involves interworking with a non ISDN network, it is requested that Study Group XI consider for further study the following principle for adoption:

It shall be a principle of an ISDN that there shall be consistency in the call supervisory signals as perceived by the caller at the human-machine interface. This consistency shall apply within a class of calls (eg., voice calls, data calls, etc.), not necessarily across classes of calls.

This principle is being proposed to avoid the undesirable possibility that, for example, a voice call that originates on an ISDN but terminates on a non ISDN network might return audible ringing to the caller, whereas a completely intra ISDN voice call might not produce audible ringing.

In consideration of this consistency principle, attention should be given to the location of the functions to be performed in order to minimize overall cost to the customer. For example, should every terminal be equipped with a ringing tone generator, or should a B channel be cut through to the local exchange during call set-up so that audible ringing can be provided to a caller of a voice call that does not involve interworking with a non ISDN voice network? There are significant human factors issues that should be considered by Study Group XI when developing its signalling procedures that will apply to voice and non voice calls made over an ISDN when interworking with non ISDN networks result in different call handling procedures.

REVIEW OF CONTRIBUTIONS

WHITE documents

N0.83 (Hungary) - Proposes ammendments is G800 and G900 series.

N0.114 (WP II/3) - Already considered in the Munich meeting.

N0.128 (SG XI) - A number of SGXI reports are referenced for the interest of SGXVIII. It is believed that most of the referenced reports have been superseded by temporary documents refering to later meetings of SGXI Working Parties. The advice of the Rapporteur for liasion between SGXI and SGXVIII is requested to identify any specific network issues not covered in temporary documents.

N0.129 (SGIII) - Provides SGIII results of an ISDN questionnaire and requests SGXVIII to provide input on the definition of the ISDN to SGIII. Some preliminary indications of the tarrieff parameters relative to the ISDN are given.

N0.130 (U.S.A.) - Suggests an ISDN internetworking Philosophy involving national and international network selection.

N0.135 (Special Rapporteur Question 13/II) - Provides SGII views on ISDN routing arrangements and proposes a new version of Recommendation E171, currently known as E17X. SGXVIII must provide inputs to the SGII studies.

N0.136 (SGII) - AS 135 above. Requests SGXVIII reference to draft recommendation E17X.

N0.138 (SGXVI) - Suggests that echo control in an ISDN be located in digital voice terminals.

N0.140 (FRG) - Notes that w information type is n x B channels with digital sequence integrity not provided by the network.

N0.146 (Rapporteur) - Identifies network issues and calls for contributions.

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No.148 (Sweden) - Suggests network objectives for network maintenance in an ISDN and some provisional allocation of maintenance function responsibilities.

NO.149 (Canada-BNR) - proposes a mapping of access information types to network connection types as a basis for discussion of end to end connections.

No.151 (Sweden) - Categorises services units bearer services and communication services and suggests the relationship to network functions.

Delayed Documents

GZ (FRG) - Suggests replies to questions raised by WPXI/4 on access channel structures and sub channels in a B channel. The relation to network connection types needs to be established. Should also be considered by Working Teams 1 and 6.

HA (FRG) - Recommends that autonomous subchannels in the B channel are not justified and proposes a response to WPXI/4 to that effect confirming previous view expressed in COM XVIII/R8.

HC (FRG) - Proposes an evolution of the access network and network interfaces. Also provides some Parameters for technical implementation at the S reference point. Should also be considered by Working Teams 1 and 2.

HD (ECMA) - Expected to provide some guidance on network maintenance philosophy. Text not-yet-seen.

HG (FRG) - Describes requirements for end to end signalling with particular reference to PABXs. Switched Virtual Circuits are proposed for end-end signalling matters than datagram type messages. An identifier for differentiating between link by link and end to end signals is recommended. A quasi permanent link between PABXs is suggested to provide signalling to set up B channel connections.

HH (FRG) - Examines delay performance and priority of signalling information over the D channel. Applicable to network studies in the relationship to the use of the D channel for packet connections and the impact on signalling delay performance.

HI (FRG) - Examines the need for a supervisory function on the signalling capability across the access interface. To confirm, for example, the ability of the signalling to clear down a connection.

HK(ISO) - Draws the attention of SGXVIII to the potential problem of automatic calling units.

HQ (NTT) - Discusses methods for providing compatibility between called and calling terminals. Three alternative network examples are proposed.

HR (NTT) - Discusses signalling protocol arrangements for connections through a PBX. The impact on network call control needs to be examined.

HU (NTT) - Examines issues related to loop back testing. Provides input to the establishment of an ISDN network maintenance philosophy.

IA (France) - Proposals for a draft recommendation on the functional architecture of ISDN. Text not yet seen.

IB (France) - Discusses principles of ISDN and evolution from existing networks. Presents a draft protocol for Recommendation I0040 (currently G705).

ID (France) - Proposals for an international numbering plan.

IF (France) - Considerations on intermediate channel structures.

IH (FRG) - Portability and compatibility.

II (FRG) - Provisionally allocated to WT 3. Suggest more applicable to WT 1.

IK (USA) - Defines the 64kb/s circuit switched network connection by a selection of attributes. Includes some features related to network control e.g. transmission path selection, alternate voice/data connection etc.

IL (USA) - Defines the 64 kb/s non switched (leased) connection in similar format to IK.

IM(USA) Discusses connections between the access and network for non switched (leased) 64 kb/s bearer service. Use of sub rate channels within the B channel are proposed.

IO (USA) - Introduces the concept of multi media calls and addresses the different categories of call under multi media consideration. Network control aspects of multi media are considered.

IT (Canada BN R) - Categorizes information arriving at the exchange to help identify level 3 addressing requirements in the network to support all level 7 addressing between terminals.

JA(KDD) - Suggests requirements for an international ISDN numbering plan. Analyzes E163 and X121 for their suitability for the purpose.

JB(KDD) - Discusses the need for an SIC in the ISDN. Some examples of application are given.

JC(KDD) - Proposes a mapping of information types to network connection types.

JE(Canada - BNR) - Develops ideas on the interaction between public ISDN and private ISDN numbering.

JF(Canada - Teleglobe) - Addresses the issue of international network selection by users.

JJ(Canada) - A usual method of describing the ISDN functional architecture is proposed.

JL(Canada - TCTS) - Discusses options for access to new services.

JO(Canada - TCTS) - Examines application of connection types to new services implementation.

JP(Canada - TCTS) - Identifies network responsibility in determination of call completion.

JR(Sweden) - Identifies some interworking problems ISDN/analog telephony.

JS(Sweden) - Suggests a maintenance philosophy for the ISDN.

JW(Australia) - Presents some principles for ISDN evolution.

JY(Australia) - Discusses user control of alternate voice/data connections.

JZ(Australia) - Implications of 32 kbit/s on network connections and control.

KA(Australia) - Discusses sub 64 kbit/s connections in ISDN.

KB(Australia) - Develops some concepts towards a network protocol model.

KT(BT) - Identifies network issues with change of state of a call after connection.

Temporary Doc. 19 - (Liaison rapporteur SGVII/SGXVIII)
Identifies specific issues raised by SGVII to SGXVIII.

Working Document (WT3) - Liaison rapporteur (SGXI/SGXVIII)
Identifies specific issues raised by SGXI to SGXVIII.

IX (COMSAT) - Describes an approach to ISDN HRXs.

JD (KDD) - Describes an approach to ISDN HRXs.

ANNEX 2 (to the report of Working Team 3) **A.107**TITLE: DRAFT RECOMMENDATION-I.31X-ISDN NETWORK CONNECTION TYPES

Considering that

- the ISDN concept is described in Rec. G705
- the ISDN functional architecture model is described in draft Rec. I0210
- the ISDN Protocol reference model is described in draft Rec. I0220.
- Services provided by the ISDN are described in draft Rec. I.

the ISDN requires a limited set of network connection types to support ISDN services.

1. BASIC CONCEPT OF NETWORK CONNECTION TYPES

Services provided by an ISDN are provided to the user and are the users perception of the network capabilities. Network connection types are provided by the ISDN network to support ISDN services.

ISDN services are provided to the user and are the users perception of the network capabilities. Network connections are provided by the ISDN network to support ISDN services.

To provide services to the user the ISDN will need to provide a limited set of connection types across the network between S/T reference points.

The concept of network connection types includes :-

- connection means e.g. transmission)
- control functions & protocol
- operational functions (e.g. maintenance)

The concept is shown in figure 1.

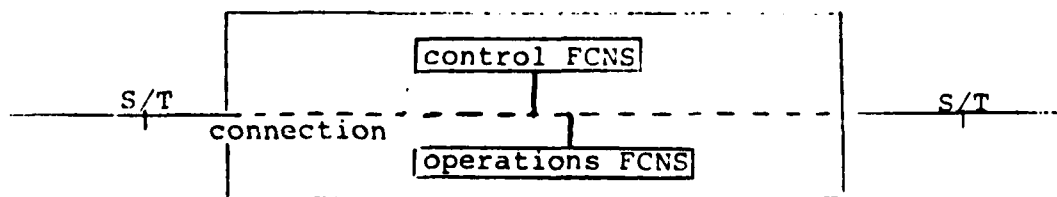


Fig. 1 - Network Connection Type Concept

An ISDN is intended to provide a limited set of network connection types.

Network connection types may be described as the ISDN network capability to support ISDN bearer services and layers 1-3 of ISDN alpha and telecommunications services (refer draft Rec. I (services)). This definition is illustrated in figure 2.

Services may alternate and therefore may require two (or more) connection types during a simple call, for example in an alternate voice/data service.

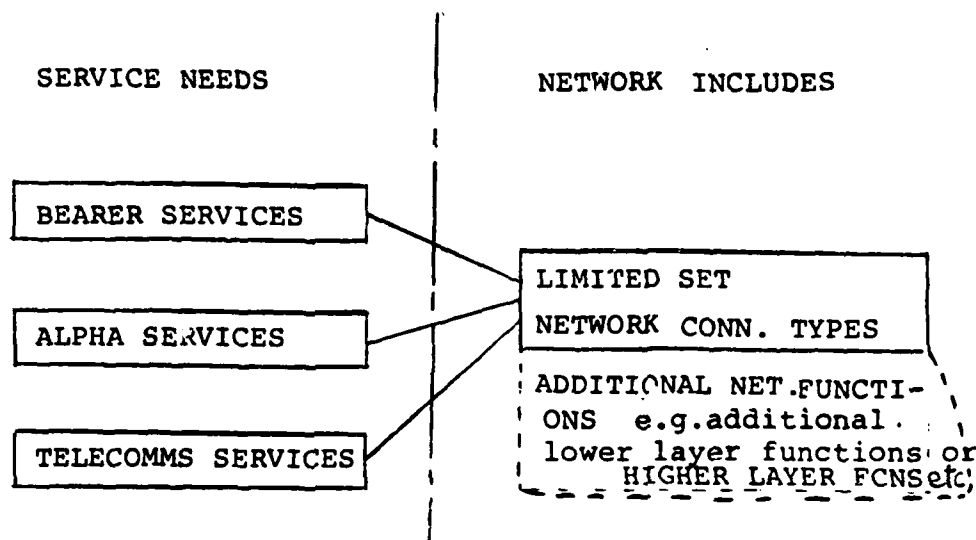


Figure 2 - SERVICE/ CONNECTION TYPE RELATIONSHIP

2. CHARACTERIZATION OF NETWORK CONNECTION TYPES

Network connection types may be characterised by :-

- Transmission capabilities e.g. bit rate
- Performance e.g.
 - Transmission Performance
 - Switching and Signalling Performance
 - Traffic Performance
 - Availability etc.
- Mode of Switching e.g. circuit or packet
- switched or non-switched

3. LIMITED SET OF NETWORK CONNECTION TYPES

The ISDN may include the capability to provide the following network connection types. All network connection types are considered to be fully duplex unless otherwise stated. The performance (reference Paragraph 2) for connection types requires further study.

A.109**3.1. CIRCUIT SWITCHED CONNECTION TYPES****3.1.1 Transparent 64 kbit/s Connection types**

These connection types will maintain bit sequence integrity between two end users. The transmission performance should be in accordance with Rec. G821.

These connection types may be -

- (a) Circuit switched on a call by call basis
- (b) Circuit switched on a demand basis
(semi-permanent switched)
- (c) Non switched or leased

NOTE: Initially these connections may provide 56 kbit/s bit sequence integrity between two end-users in some countries.

3.1.2 Non-transparent connection types

Non transparent connections to support virtual analogue bearer services (e.g. 4KHz voice). These connections may include bit manipulation and will not provide bit sequence integrity.

These connection types may be -

- (a) Circuit switched on a call by call basis
- (b) Circuit switched on a demand or semi permanently switched basis
- (c) Non switched or leased

The performance of these connection types is for further studies.

3.1.3 'Sub rate' connections at 8 Kbit/s, 16Kbit/s and 32Kbit/s. ~~These connections are for further study.~~

Identification and specification of such connections are left for further study.

3.2 PACKET SWITCHED CONNECTION TYPES

Packet switched connection types for the support of packet data connections may be :-

- 3.2.1 Switched virtual circuits, *including the fast select option.*
- 3.2.2 Datagrams
- 3.2.3 Permanent virtual circuits

Connections at the S/T interface will use the B channel or the D channel. Connections may be established from B or D channels to :-

- a) A called B channel ~~at 64 Kbit/s~~
- b) A called D channel ~~at 16 Kbit/s~~
- c) Other called packet mode DTE's via a PHF or connected PSDN, at speed supported by X.25.

Performance of these connection types is for further study.

3.3. BROAD BAND CONNECTION TYPES

These connection types and their reference are for further study.

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4. APPLICATIONS OF NETWORK CONNECTIONS

The network may include the following applications of network connections to support services as necessary. Examples are given in figures 3-6, which illustrate the connection arrangement and the associated network control for each example. Where appropriate diagrams are shown to illustrate alternative modelling approaches. Reference should be made to draft recommendation I0220 - ISDN protocol reference model for explanatory text if required on the protocol diagrams.

4.1 SIMPLE CONNECTIONS

Connections consisting of one connection type only used to provide interconnection between,

- a) two S or T interfaces, across the network.
(e.g. Circuit (Fig 3) or packet (Fig 4) switched end to end connections in one continuous time interval)
- b) S or T interface and a network node.
(e.g. Links in a message store and forward arrangement)
- c) two network nodes
(e.g. Connecting link between two data bases or a switching node and a data base)

4.2 TANDEM (OR CHAIN) CONNECTIONS

Connections comprised at more than one connection type in tandem. Typical example, access to a packet node via a circuit switched connection (see fig. 5)

4.3 MULTIPLE CONNECTIONS

- (a) Connections comprised of a number of simultaneous connections of similar connection types to provide for example an $n \times 64$ kbit/s connection. In this example the value of n requires further study. Connection applications may include :-

- (i) Circuit switched on a call by call basis.
In this case the network will not maintain bit sequence integrity for the $n \times 64$ kbit/s connection (n is initially expected to be of the order of 2-3). The traffic performance of this connection requires specific further study.
- (ii) Circuit switched on a demand or semi permanent basis
- (iii) Non switched or leased

In cases (ii) and (iii) the network may, in some cases, provide bit sequence integrity.

- (b) Connections comprised of a number of similar connection types to provide, for example, for a conference service (see figure 6).

4.4. MULTI MEDIA CONNECTIONS

Connections comprised of simultaneous applications of different connection types. Typical example simultaneous

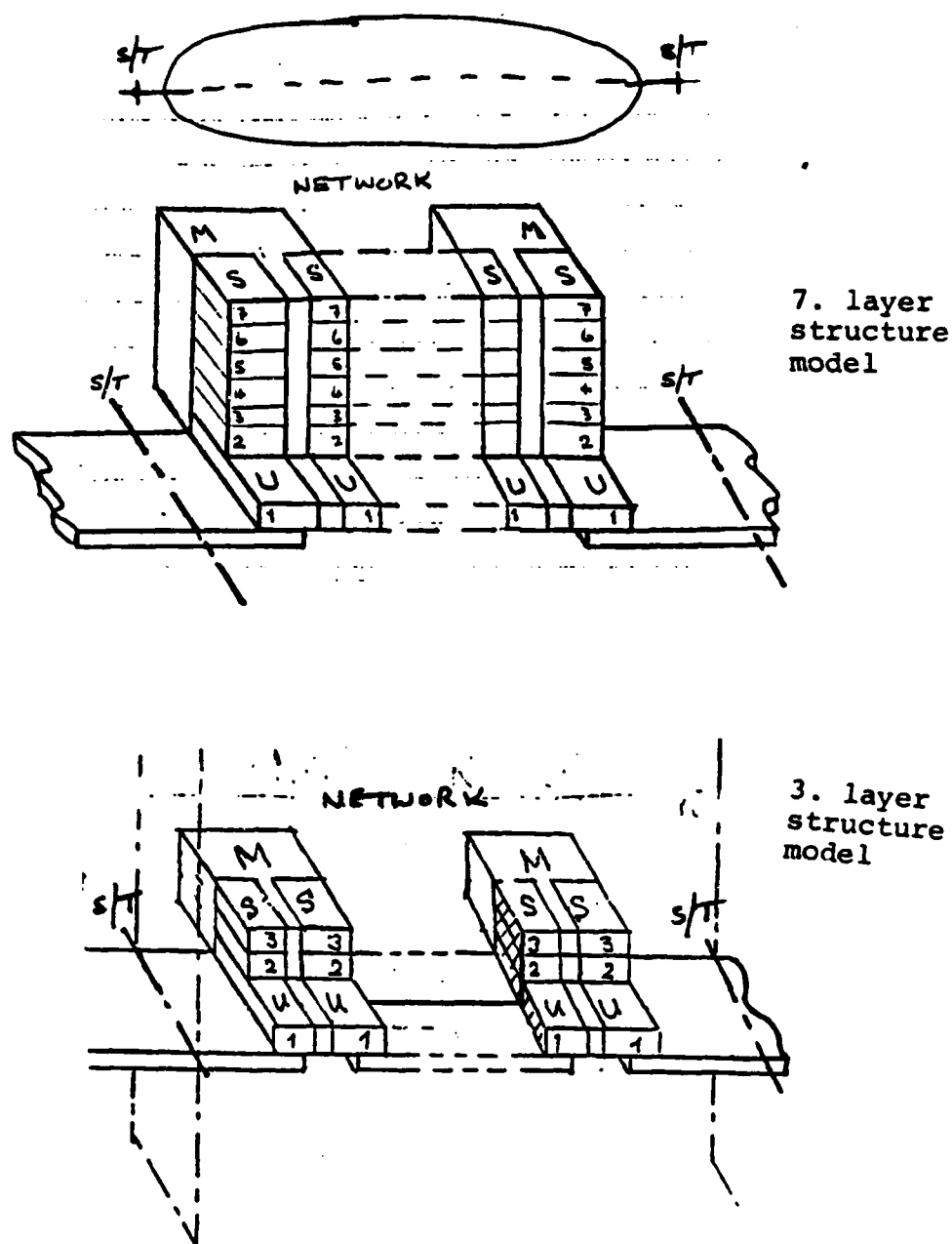


FIGURE 3 TRANSPARENT 64 kbit/s CONNECTION TYPE
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Note: Signalling information is carried from terminal to network (local exchange) by D-channel, and between exchanges by eg. CCITT No.7 system. User data protocols are end-to-end (eg. TEL to TEL).

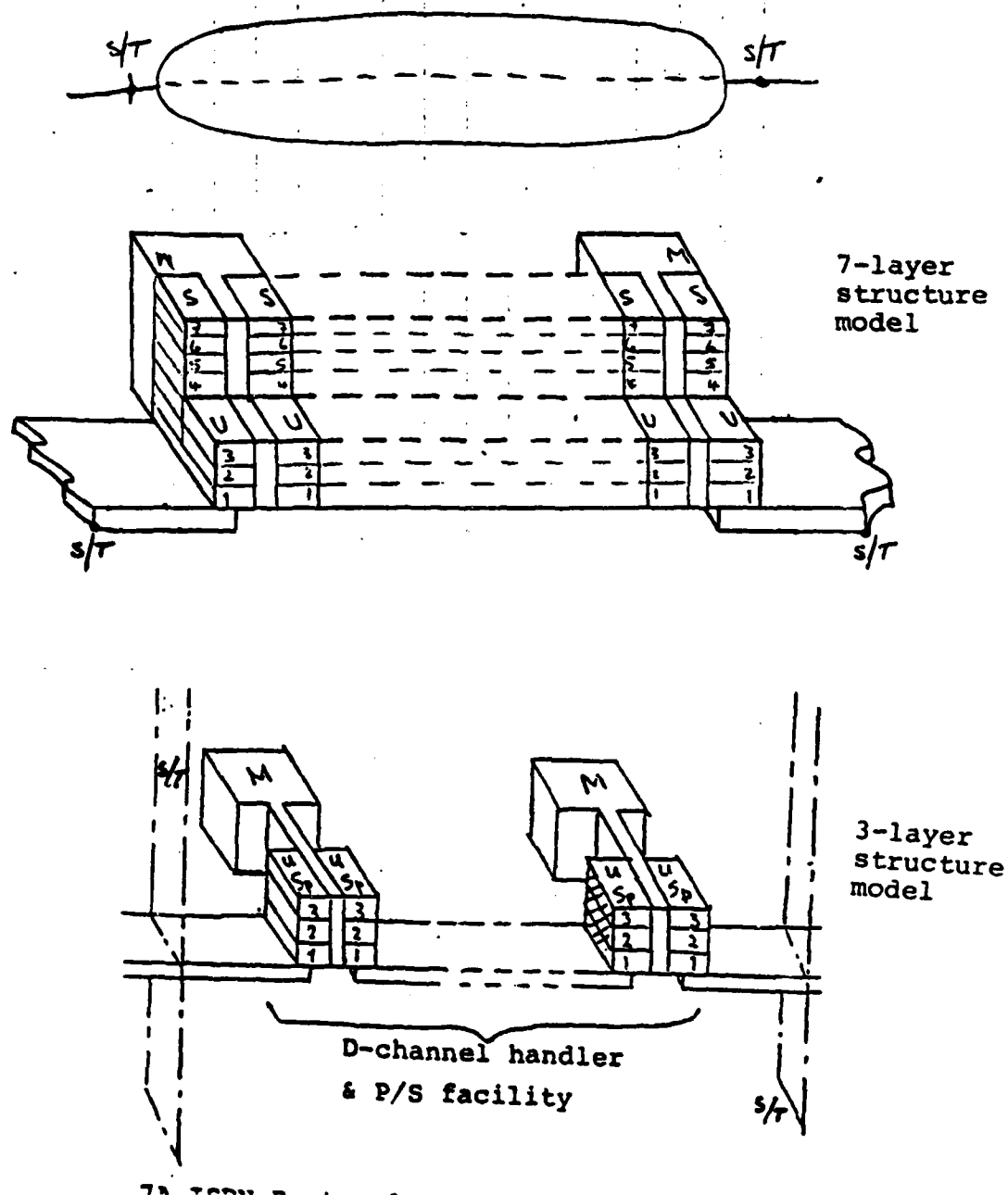


FIGURE 4 PACKET SWITCHED CONNECTION TYPE - USE OF D CHANNEL

- Note: (a) The layer - 2 functions in the local exchange may be distributed between the D-channel handler and the packet-switch.
- (b) Network control (signalling) information is multiplexed with user data. Figure shows separation of user data from signalling information at layer 3 in eg. local exchange packet switching functional block.

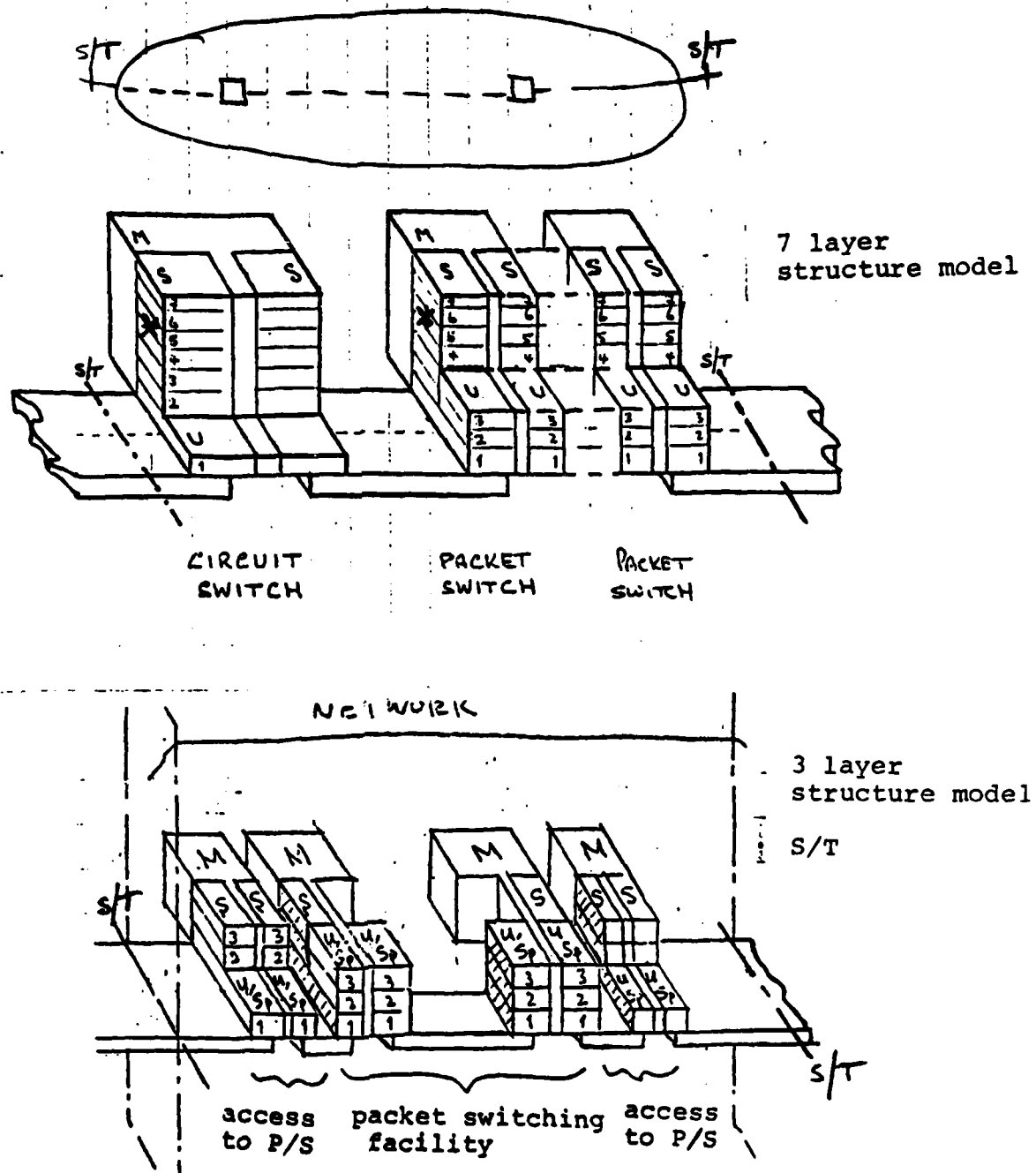


FIGURE 5 ACCESS TO A PACKET SWITCH VIA A CIRCUIT SWITCH

Note: * Indicates protocol end-point resides in terminal signalling (network control) functional block. This terminal functional block has the capability of routing signalling (network control) information via the D-channel

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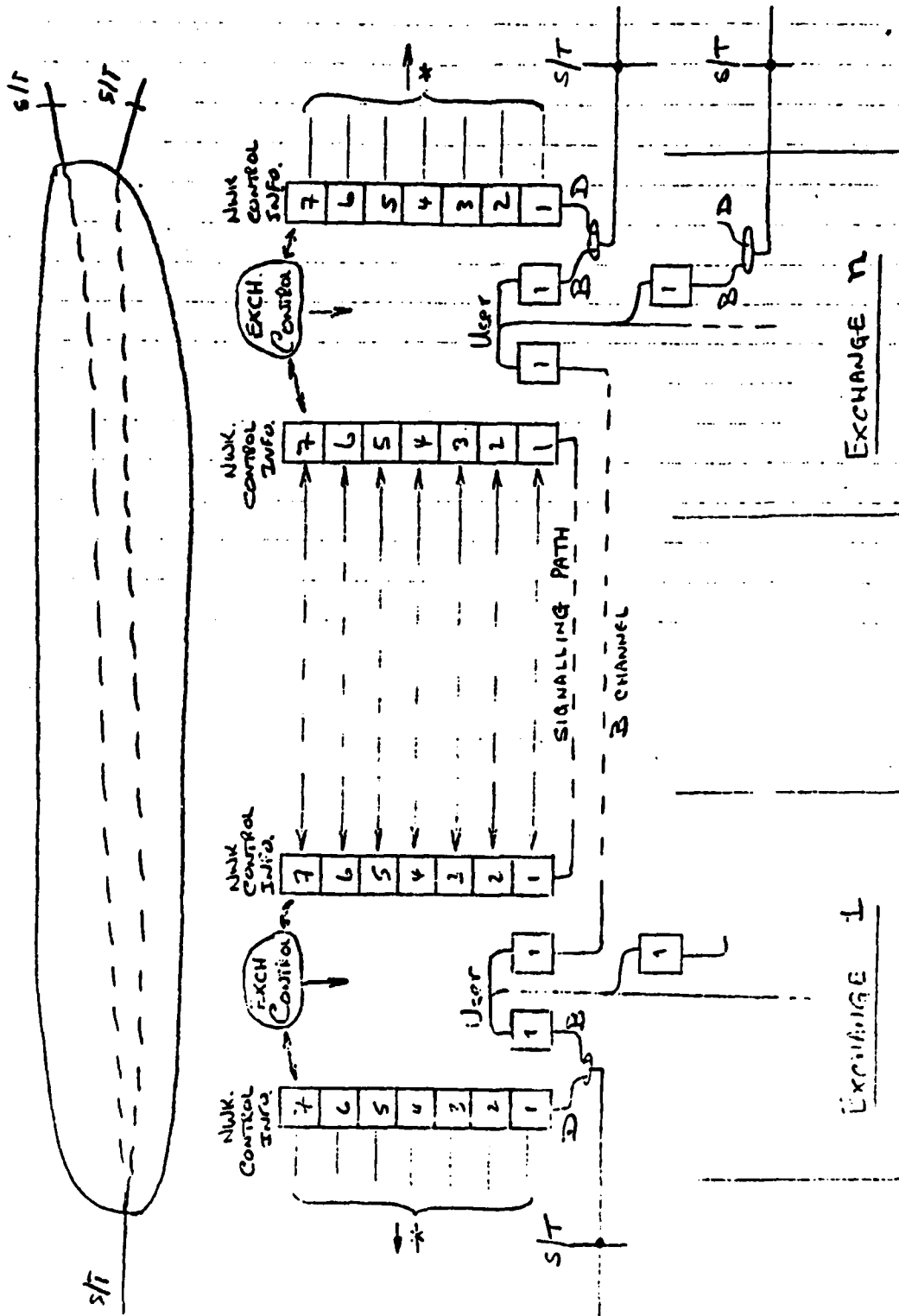


FIGURE 6 EXAMPLE FOR CONFERENCE ON 8 CHANNEL

Note: * Indicates protocol end-point resides in terminal signalling (network control) functional block.

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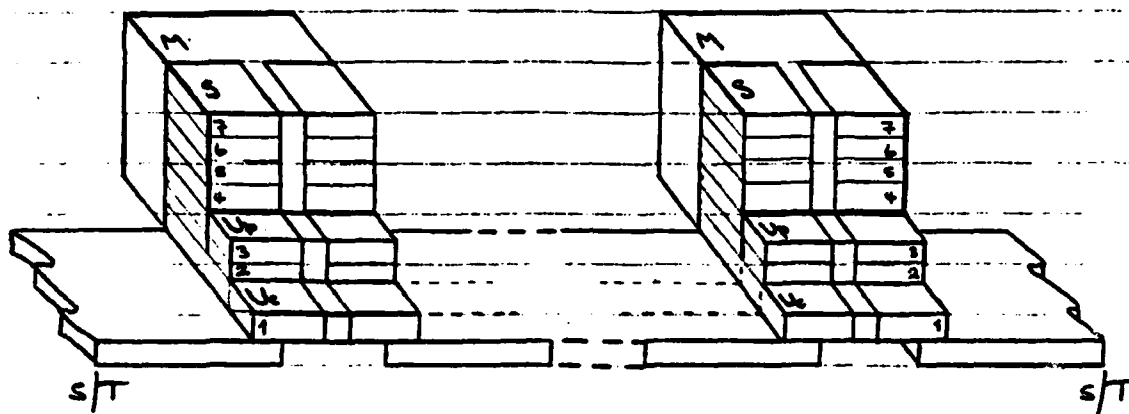


Figure 7 :-

ISDN PROTOCOL REFERENCE CONFIGURATION

- MULTI-MEDIA APPLICATION

- : Circuit switched connection type Uc
- : Packet switched connection type Up

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The material from the former Annex 3 was moved to the end of section 7. This material is now on page A.094.

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Draft Recommendation I0210 : ISDN architecture functional model

General

1. This Recommendation applies to ISDN's as defined by the I series of Recommendations. It gives a model of functions to be performed by ISDN's (Part A) as well as examples of ISDN architectures (Part B).

The objective of this draft Recommendation is to provide a common understanding of the ISDN architecture functional model to assist the study on specifying characteristics that appear at user/network interfaces, for example protocols, network performance (e.g. HRX), network routing, tariff, etc. Characteristics in the model should not preclude or inhibit any network implementation and should be considered to be examples.

Part B is not intended to propose or require a specific ISDN implementation but to provide material for setting up Recommendations on items such as Hypothetical Reference Configuration, Routing, Interworking, Numbering, etc.

2. ISDN is defined as a network providing a limited set of multipurpose connection types and possibly additional functions in order to support bearer, alpha, or telecommunication services (see I 200 on services). Each of the network connection type will in principle be able to be provided on a call by call switched basis or on a non switched basis. ISDN's connection types are defined at ISDN user/network interfaces; an ISDN may thus be defined as a network to which users are connected through a limited set of multipurpose ISDN user/network interfaces (see figure 1). The capabilities of ISDN's are mainly defined by following I series Recommendations:

- I120 which gives the principles of an ISDN,
- I200 which specifies the services to be provided by an ISDN,
- I3xx which specifies ISDN's connection types,
- I330 and I331 which specify the overall performance objectives for ISDN connection types,
- I411 which identifies the recommended ISDN user/network interfaces,
- Ixyz which specifies the technical characteristics of these interfaces.

During a long intermediate period, some features may not be implemented within a given ISDN. Also specific arrangements should be used in order to ensure compatibility with existing networks and services. These features and arrangements are specified within section 5 (part III) of the I series of Recommendations. ISDN should also give access to existing services and interwork with existing networks and terminals; in some countries this situation is likely to exist even in a very long term.

Part A - Functional Model

In the following a first attempt of functional modeling of an ISDN is provided. This model uses a concept of layered architecture. The levels identified so far have no direct relation to those layers defined by the OSI protocol model. It is also recognized that the concept of a network functional element needs to be described more accurately. Both definition of concepts and correlation with the OSI protocol model need further studies.

1. THE METHODOLOGY

The logical perspective of a system being designed (in this case an ISDN) can be abstracted into an "onion-skin" partitioned into consecutive concentric level of functional element, each representing a purely logical view of the system at that level. Each functional elements presents a logical interface to the level above it. A level has access to all functions provided at the interface by the level immediately below it. Furthermore, the existence of mutually exclusive modes of operation can be depicted as radial partitions within a specific logical level. Refer to Figure 2.

The determination of the set of functional elements which will comprise the logical design depends on an analysis of the functional requirements and specifications, i.e. on what the network must do. This partitioning process undergoes several iterations until the logical design is completed and validated against the network specifications.

Note that the "onion-skin" model only serves as an overall perspective of the network and as a basis for structuring and modelizing the network design. Successive refinements of the functional elements themselves can be approached, for example, in a top-down manner using data or control flow as a basis, and described via structured diagrams or similar descriptive mechanisms.

Note: The pertinence of the "onion-skin" (radial) representation requires further study.

2. APPLYING THE METHODOLOGY TO THE ISDN

Applying the above principles to the ISDN, an initial pass would result in the diagram shown in Figure 3. The ISDN can be perceived as working in either of two major modes of operation : performing subscriber services, or network administration and maintenance.

The radial partitioning in figure 3 separates functions performed to provide services perceived by the customer from internal network functions needed to operate, manage and maintain the network and are solely perceived by the operating staff.

A.119

Subscriber services could be classified into bearer services and alpha services (See Recommendation I 200 on services). Bearer services are provided using connection functions through the network and operational and/or commercial functions. Alpha services are provided using high layer functions within (or associated with) the network and operational and/or commercial functions. The logical interface provided by the connection functions is shown by the heavy black line on the diagram. In this way, this division also allows the subscriber to use the network merely as a transport facility.

Note that a given ISDN service need not require all levels to be ~~achieved~~. For instance, ISDN connections will not need any functions to be performed in the basic high layer functions (HLF) level.

Following through this partitioning process, the interrelationships of the various services could more easily be identified. Note that the level of detail increases as we go further into the "onion", with the inner levels increasingly becoming transparent to the outer levels. It is not necessary that a common central core be arrived at - it may not exist for the system being designed.

Part B - Architectural Model

This part of the Recommendation is not intended to require any specific implementation for an ISDN but only to provide a guide for the specification of ISDN capabilities.

1. - DEFINITIONS

1.1 - Reference configurations are conceptual configurations useful in identifying various possible arrangements to an ISDN. Two concepts are used in defining reference configurations: reference points and functional grouping.

Layout and application examples of reference configurations are given in Section 2 and 3.2.

1.2 - Functional groupings are sets of functions which may be needed in ISDN arrangements. In a particular arrangement, specific functions in a functional grouping may or may not be present. Note specific functions in a functional grouping may be performed in one or more pieces of equipment.

1.3 - Reference points (R,S,T,V) are the conceptual points at the conjunction of two functional groupings. In a specific arrangement, a reference point may correspond to a physical interface between pieces of equipment, or there may not be any physical interface corresponding to the reference point. Physical interfaces that do not correspond to a reference point (e.g. transmission line interfaces) will not be the subject of ISDN Recommendations.

Note: Definition of functional grouping LT and CRF are given in section 2; further study is required for refinement.

2. - ISDN REFERENCE CONFIGURATION

Figure 4 gives the general ISDN reference configuration divided in three parts :

- Customer network
- local network
- transit network

Recommendation I 411 describes more precisely the reference configurations for ISDN user/network interfaces, while Recommendation I 412 specifies the channel structures to be used at reference points S and T. An ISDN connection is seen by a user from the user/network interface at reference point S or T (see Figure 5).

The local network includes the set of equipments located in the connection area of a local exchange, including NT1. It mainly comprises the local access and the serving local center, including line termination (LT) and Connection Related Functions (CRF). The functional grouping CRF may include functions such as exchange terminations switching, control, network management, operation and maintenance etc. It corresponds to one (or more) exchange(s) and possibly other equipments, such as muldexes or concentrators or electronic cross connect equipments. It is understood that all functions referred to in the functional grouping CRF do not have to be performed for all connection types. As an example, only network management functions would be performed in the case of a non switched 64 kbit/s connection type. Reference point V divides functional groupings line terminal (LT) and Connection Related Functions (CRF). The transit network is the set of equipments used to inter-connect all local networks.

3. Overall Architecture of an ISDN

A basic component of an ISDN is a network for circuit switching of end to end 64 kbit/s connections. It will be named circuit switched part of an ISDN. Depending on national situation this network may or may not handle other connection types, such as packet switching. However, ISDN evolution could start in a different manner; for instance, at early stages ISDN subscribers could be provided only with ISDN packet switched services in the case of an hybrid user access arrangement (see I412).

Note: Concerns were expressed on the definition of the circuit-switched part of ISDN. The above text needs further revision.

3.1 Architectural Model of an ISDN

Figure 6 shows the seven main switching and signalling functional components of ISDN as far as ISDN connection types are concerned:

- ISDN local connection related functions (CRF) (e.g. user/network signalling, charging),
- narrow band (64 kbit/s) circuit switching functional entities,
- narrow band (64 kbit/s) circuit non switched functional entities,
- packet switching functional entities,
- common channel interexchange signalling functional entities, for example, conforming to n°7 CCITT signalling system specification,
- broadband switched functional entities,
- broadband non switched functional entities.

Note: *the identification and definition of functional entities for 18, 16, 32 kbit/s multiplexed nonswitched is left for further study*

These components need not be provided by distinct networks but may be combined as appropriate for a particular implementation.

A.122

Higher layer functions implemented within (or associated with an ISDN may be accessed by the means of any of the above mentioned functional entities.

Those functional entities could be implemented totally within an ISDN or may partly correspond to dedicated networks. Both cases may provide the same ISDN bearer or alpha service (see Recommendation I.200 on services) and comply with the same Hypothetical Reference Connections (HRX's).

In the case where packet services are provided on the D channel, the local center will have to perform some functions related to packet handling, and may even provide packet switching functions where appropriate.

In all cases circuit switching and/or common channel signalling functions will be performed by ISDN local centers.. During the early stage of ISDN, packet switching functional entities may be located in the exchanges of dedicated public network for data, designed in conformity with CCITT X series of Recommendations.

Also the set of circuit switching functional entities may comprise a terrestrial IDN evolved from the present telephone network as well as satellite system switching networks.

Note: Inclusion of Additional low layer functions (ALLF) in the model requires further study.

3.2 - Local network

The local network comprises :

- transmission line systems, including network termination 1 (NT1)
- remote muldaxes and switching units,
- a local serving center

The digital local serving center is understood as a set of functional entities, some of them being specified by CCITT Recommendations. Depending on national conditions a local exchange complying with an international Recommendation may be implemented in a unique centralized equipment or distributed in a set of separate sub equipments, some of them being remotely located.

Functional entities NT1 and NT2 may be integrated within the same equipment (cases b-e) or separated by a physical interface at reference point T (cases c,d,f,g,h). In cases where a complex customer installation is provided with more than one basic access, n basic channel structures may be used which could be downwards multiplexed into a multiplexed channel structure at the primary or intermediate bit rate (case d). Another possibility consists in using a primary rate channel structure at T reference point. Depending on the actual access capability and on transmission considerations, an intermediate bit rate transmission system could be used downwards.

The list of examples in figure 7 is not exhaustive. Other configurations could also take place, such as combinations of some configurations identified by figure 7.

3.3 - Transit network

The transit network could be homogeneous. In this case, the same digital links and the same digital switching nodes are used to set up communications for all the services offered to a customer; The transit network could also be non homogeneous. In this case the

same digital nodes are used to set up communications for a part of the services offered to a customer, while specialized functional groupings are used for the rest of the services. This Recommendation applies to both cases.

A.123

An ISDN may have arrangements with specialized networks.

These specialized networks will offer services (e.g. public data network services) that are either available or not available within an ISDN. Some of the specialized networks could be integrated into an ISDN in the future, depending on national conditions. Connections have to be allowed between Terminals, both connected to an ISDN, or for Terminals where one is connected to this ISDN and the other is connected to the specialized network. The interworking requirements have to take account of these arrangements. Examples of possible interworking indications are given in figure 8 and 9.

The specialized network may be composed of dedicated transmission and switching facilities or be restricted to a set of special nodes linked together via connections, provided through the circuit switched part of ISDN network, as illustrated by figure 10 for the example of a packet switching network.

4. - FUNCTIONAL ASPECTS OF ISDN

4.1 - Circuit switching in ISDN

Circuit switched connections are carried by B channels at the ISDN user/network interfaces and switched at 64 kbit/s by the circuit switching functional entities of ISDN.

Signalling associated with circuit switched connections is carried by D channels at the ISDN user/network interfaces and processed by the local exchange. User to user signalling is routed through the common channel signalling functional entities.

User bit rates of less than 64 kbit/s may be rate adapted to 64 kbit/s before switching in ISDN. Moreover X1 circuit switched data services, with bit rate less than 64 kbit/s may be handled by a dedicated circuit switched data network to which the user gains access by means of an ISDN connection.

Non transparent applications such as telephony applications of ISDN circuit - switched capabilities may also employ non-transparent transport channels (e.g. packetized voice, digital speech interpolation).

Channels at 8, 16 or 32 kbit/s may be used in the transmission part of the network; they may be used to carry non transparent connection types/ e.g. suited to a virtual 4kHz channel. They may also be used in cases where 64 kbit/s channel (B channel at S or T reference point) carries user data streams at bit rates lower than 8, 16 or 32 kbit/s respectively.

Connection types at higher bit rates could also be provided by this network on a semi-permanent basis. Switched connections at these bit rates could also be provided by broadband switching functional entities.

4.2. - Packet Switching in ISDN

Packet switching functional entities of an ISDN may be centralized in a set of specialized switching nodes or distributed and integrated with the 64kbit/s circuit switching features within the exchanges forming part of the basic transit network.

Both implementations are regarded as fulfilling ISDN requirements.

Protocols used between these nodes should conform to CCITT X series of Recommendations.

Packet switched services are routed to the packet switching functional entities of an ISDN.

A number of methods may be used to access packet switched services in an ISDN. One group of methods accesses services via a B-channel, A second group of methods accesses services via a D-channel.

Methods which could be used are;

(i) B-channel packet access

- circuit switched through a local exchange to a dedicated PSN
- circuit switched through a local exchange to a packet network that is part of the administrations ISDN
- packet-handling functions provided within the local exchange

(ii) D-channel packet access

- processed through a local exchange to a dedicated PSN,
- processed through a local exchange to a packet network provided by the administrations, using CCITT recommended or an internal network protocol
- packet switching in the local exchange.

The interworking services and protocols are defined in Recommendation I1570, support of X25 DTE's (presently under preparation within COM VII).

4.3 - High layer functions (HLF)

Provision of "Higher layer functions" could be made either via special nodes in an ISDN' belonging to the public network or centres operated by private companies and accessed via

ISDN user/network or internetwork interfaces. Some features - such as mailing boxes - encryption - will be used on a very large scale and the relevant functional entities could be implemented within the exchanges themselves.

For both cases the protocols used to activate such features should be identical and integrate with the general user procedures defined for the activation of ISDN communication services.

A.125

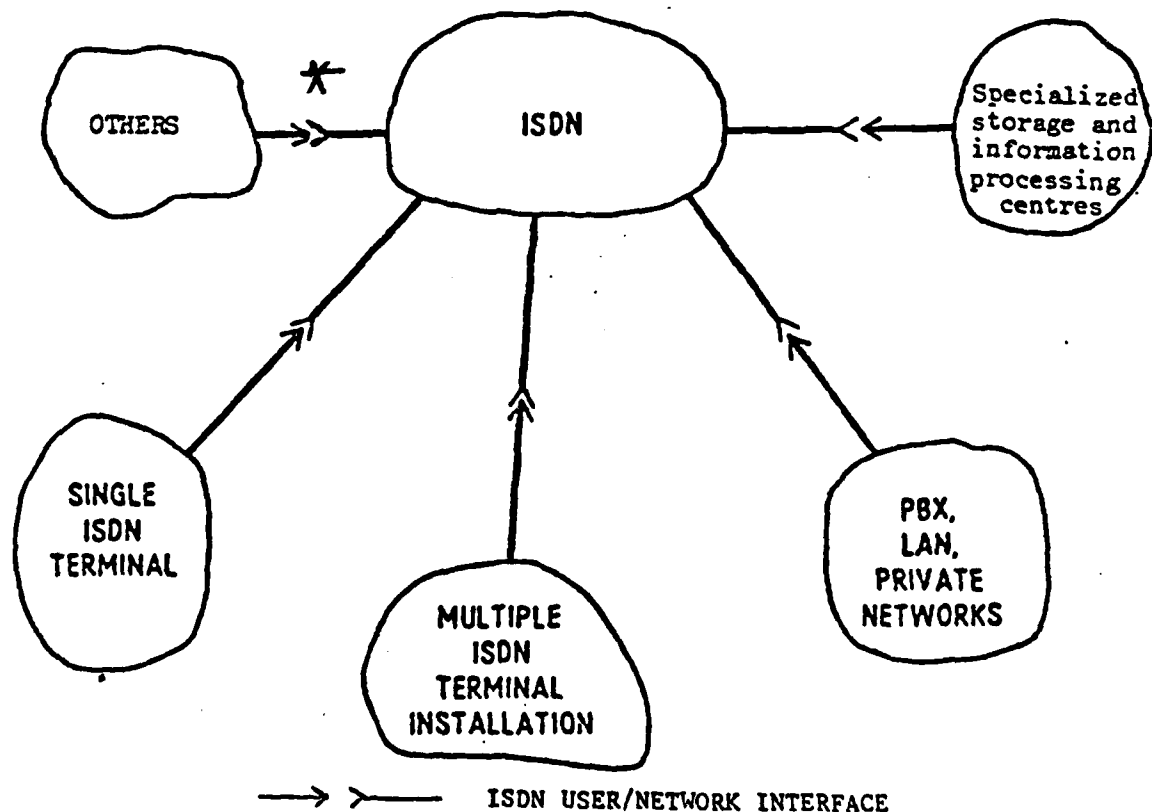
5. Relationship with specialized networks

It is important to note that the introduction of ISDN capabilities into a network requires a massive development effort. Consequently, 'Administration or RPOA's will be introducing various ISDN functions successively over a course of time. For example, the 64kbit/s circuit switched capability may be introduced initially, followed later by provision of packet switching features, and so on.

An ISDN will therefore have to interwork with a set of various specialized networks or terminals, in order to :

- (i) provide ISDN connections to non ISDN terminal equipments (TE2),
- (ii) provide a non ISDN Terminal Equipments (TE2) connected by means of a terminal adaptor (TA) with access to non ISDN services provided by a dedicated services network,
- (iii) ensure that an ISDN terminal connected to ISDN interworks with an non ISDN terminal connected to a dedicated network.

Figure 1. illustrates the interconnections of ISDN with various dedicated networks.



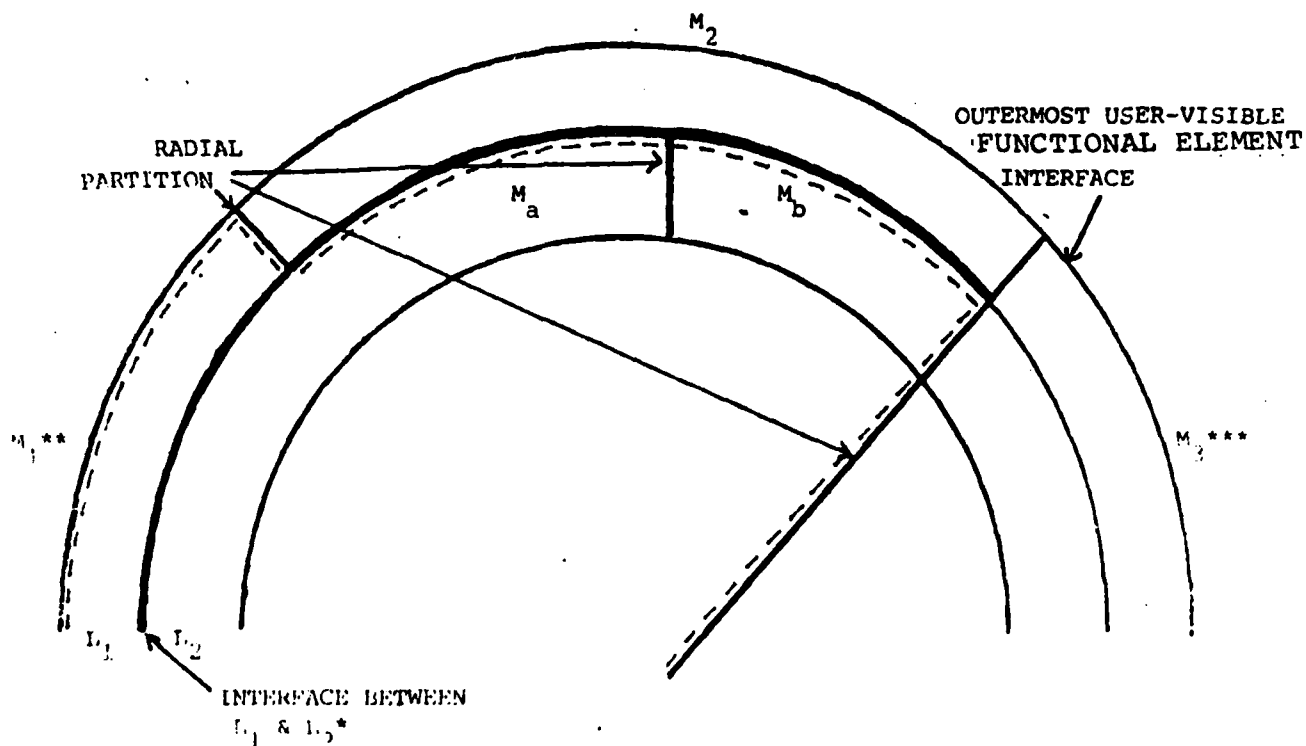
* Alternatively internetwork interfaces may apply

- ISDN USER/NETWORK INTERFACE EXAMPLES -

A.126

Figure 2 / I0210

THE ONION-SKIN MODEL



Legend:

M_k - mode of operation (separated by radial partitions).

L_i - logical layer representing a functional grouping

$[f_{i_1}, \dots, f_{i_n}]$.

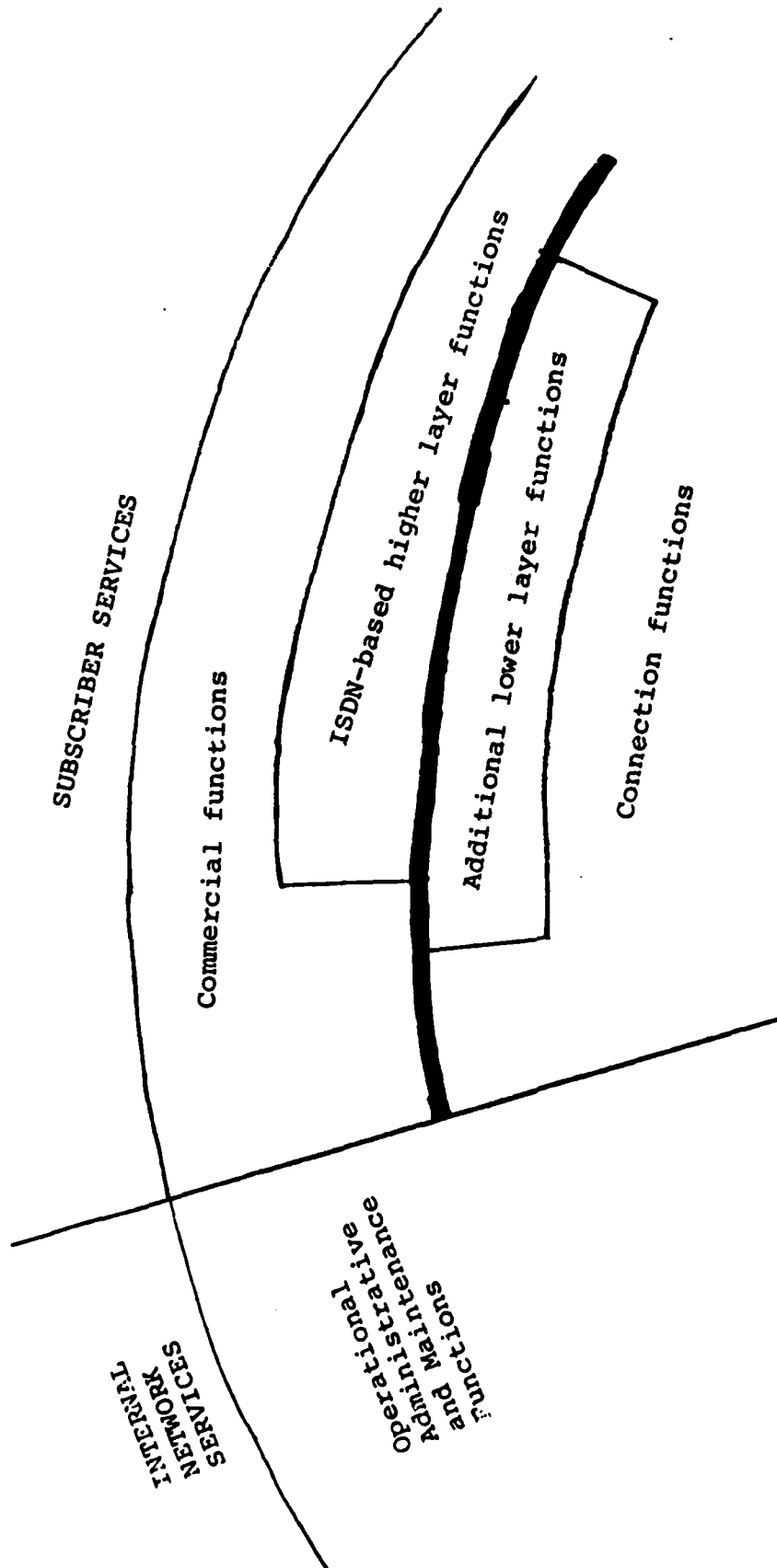
Explanatory Notes:

* This shows that Layer 1 (L_1) of Modes M_1 and M_2 in fact share a common logical interface to L_2 , i.e. all the functions provided at the interface (heavy black line) by L_2 are available and common to L_1 of both M_1 and M_2 .

** Dashed lines represent the superset of functional elements associated with Mode M_1 . This superset may also be considered a functional element.

*** The radial partition down to the centre implies that M_3 does not share any functions in common with either M_1 or M_2 .

A.127

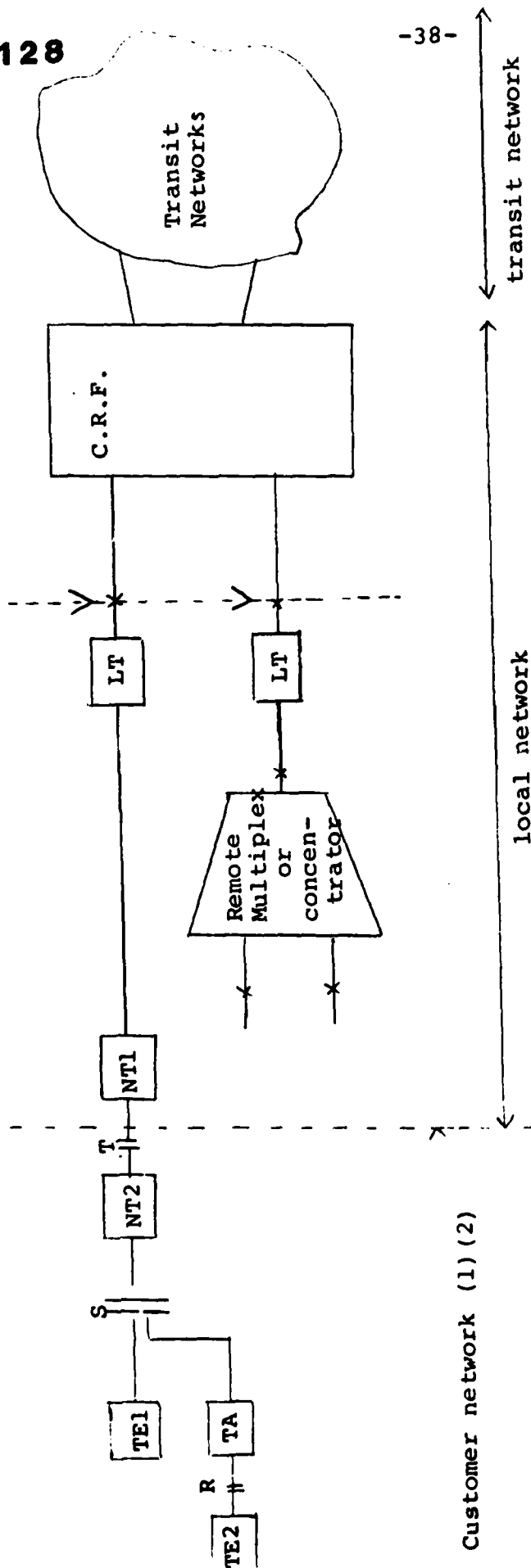


Note 1: Connection functions are divided into a set of various connection types.

Note 2: A given ISDN service need not require all levels to be activated.

Fig. 3 Initial Partitioning of Network Functions

A.128



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Note 1 - NT 1 functional entity could be located within the subscriber premises in some cases and outside the subscriber premises in other cases

Note 2 - For some countries, the customer network could be connected to more than one local network and possibly more than one transit network

Note 3 - Customer network, local network, serving local center transit network do not refer to functional groupings.

TE : Terminal Equipment
NT : Network Termination
LT : Line Terminal

CRF: Connections Related Functions

Figure 4 / I0210 Typical examples of a reference configuration for the ISDN

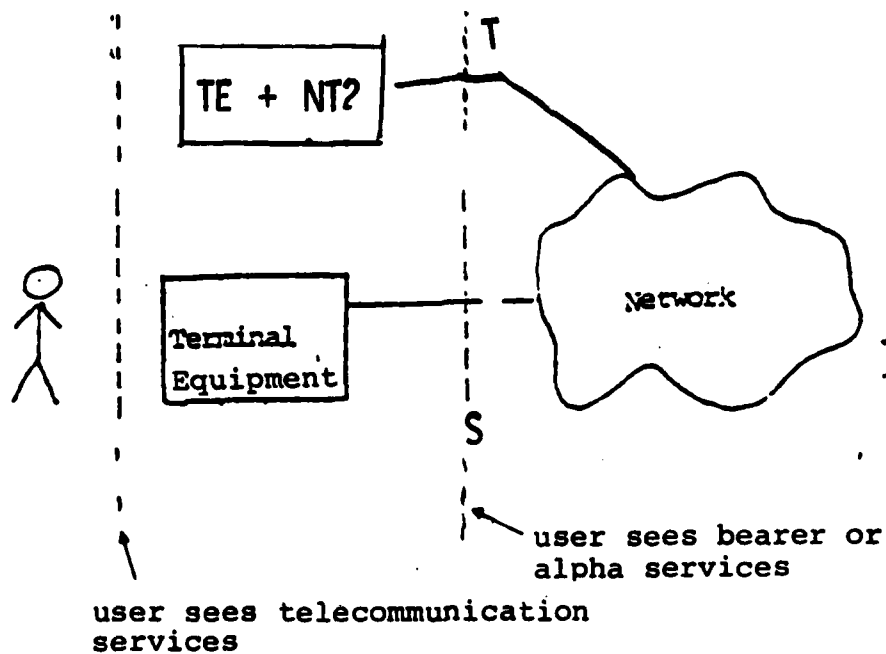
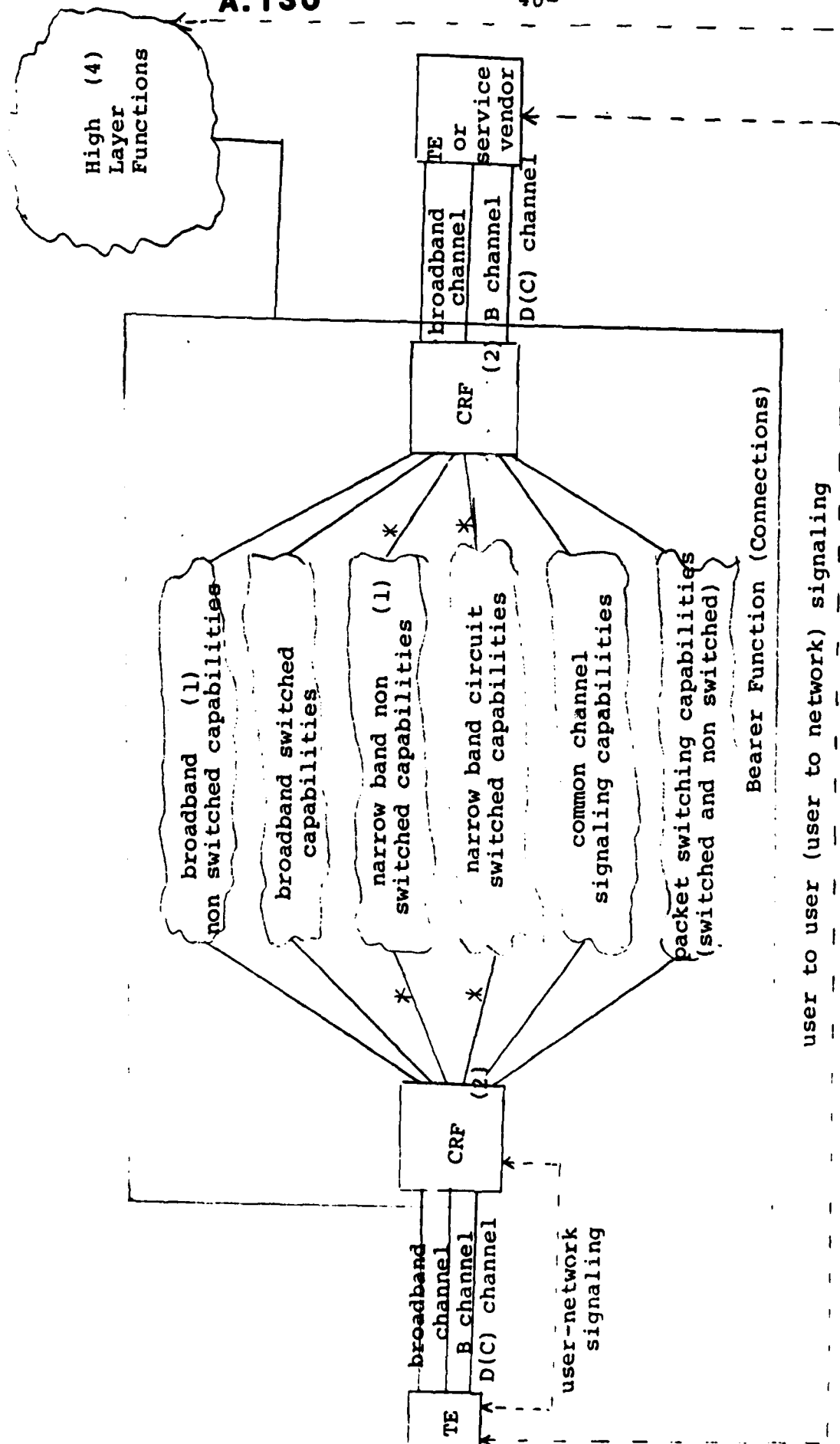
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figure 5 / I0210 Reference for defining ISDN capabilities



text for 8, 16, 32 kbit/s

figure 6 / I0210 Architectural model of an ISDN

A.131

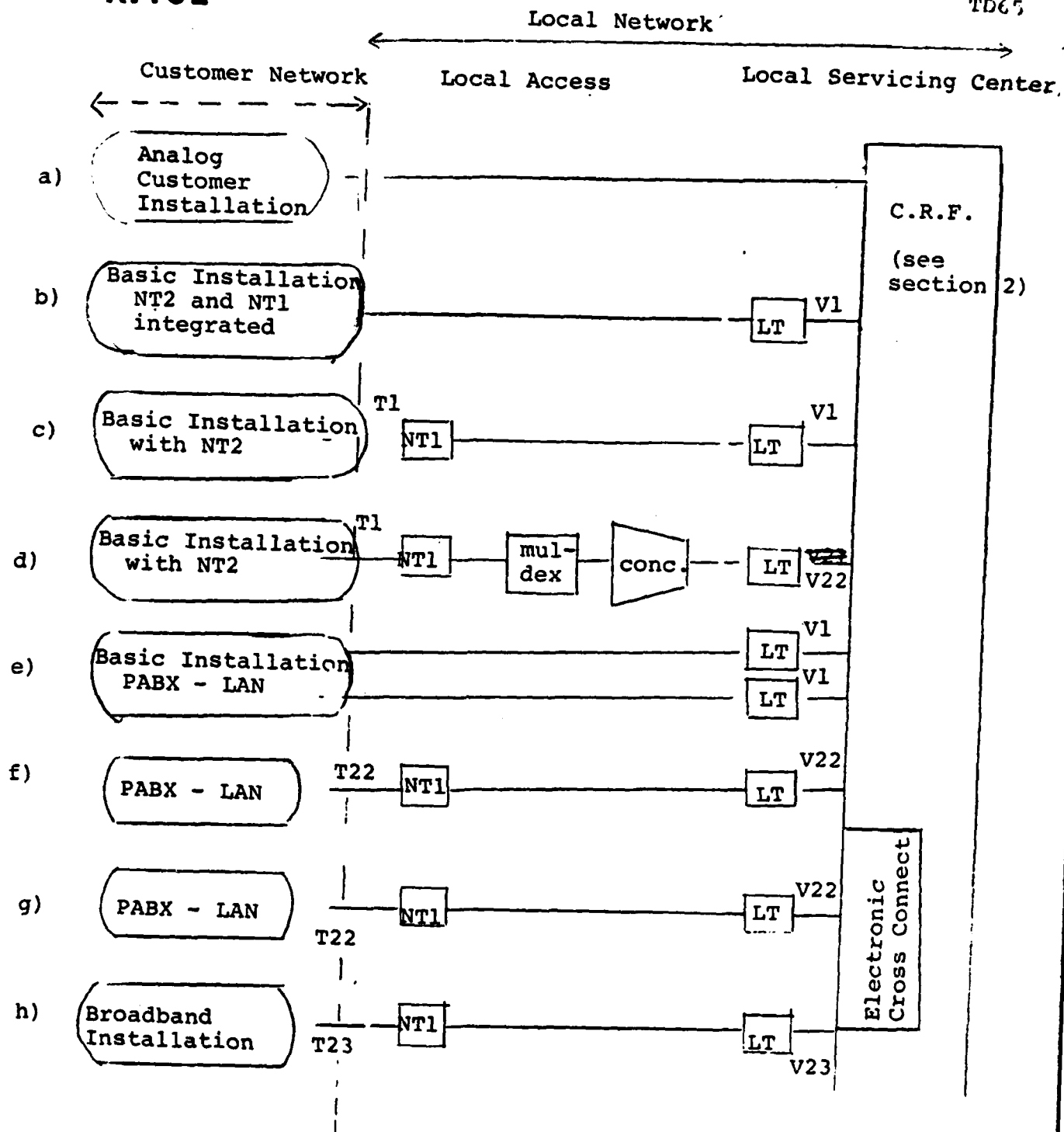
Note 1 : The appropriate name of these capabilities will be further determined following results of discussions under bearer services and connection types.

Note 2 : The connection related functions (CRF) corresponds to a local exchange and possibly other equipments such as electronic cross connect equipments, muldexes, etc. (See part B section 2).

Note 3 : For some countries, the user network could be connected to more than one local network and possibly more than one transit network.

Note 4 : These functions may either be implemented within ISDN or be provided by separate networks.

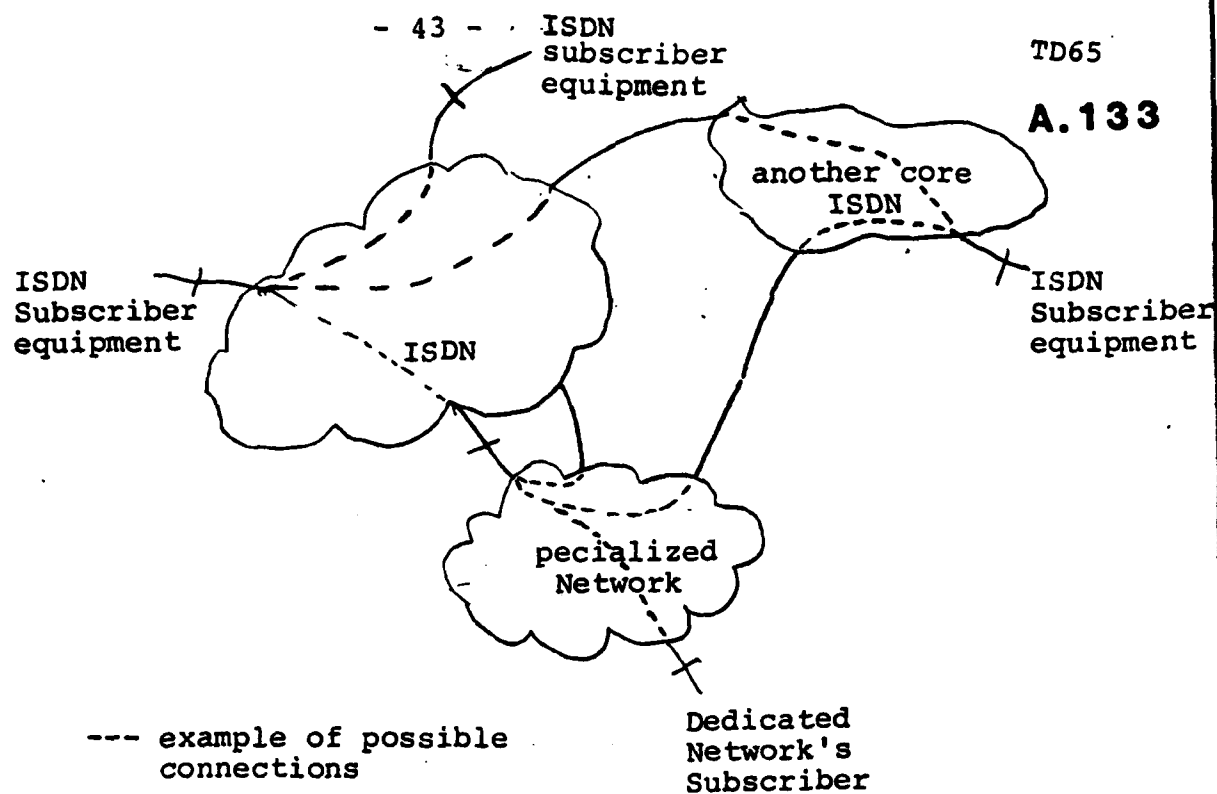
Notes to figure 6 / I0210



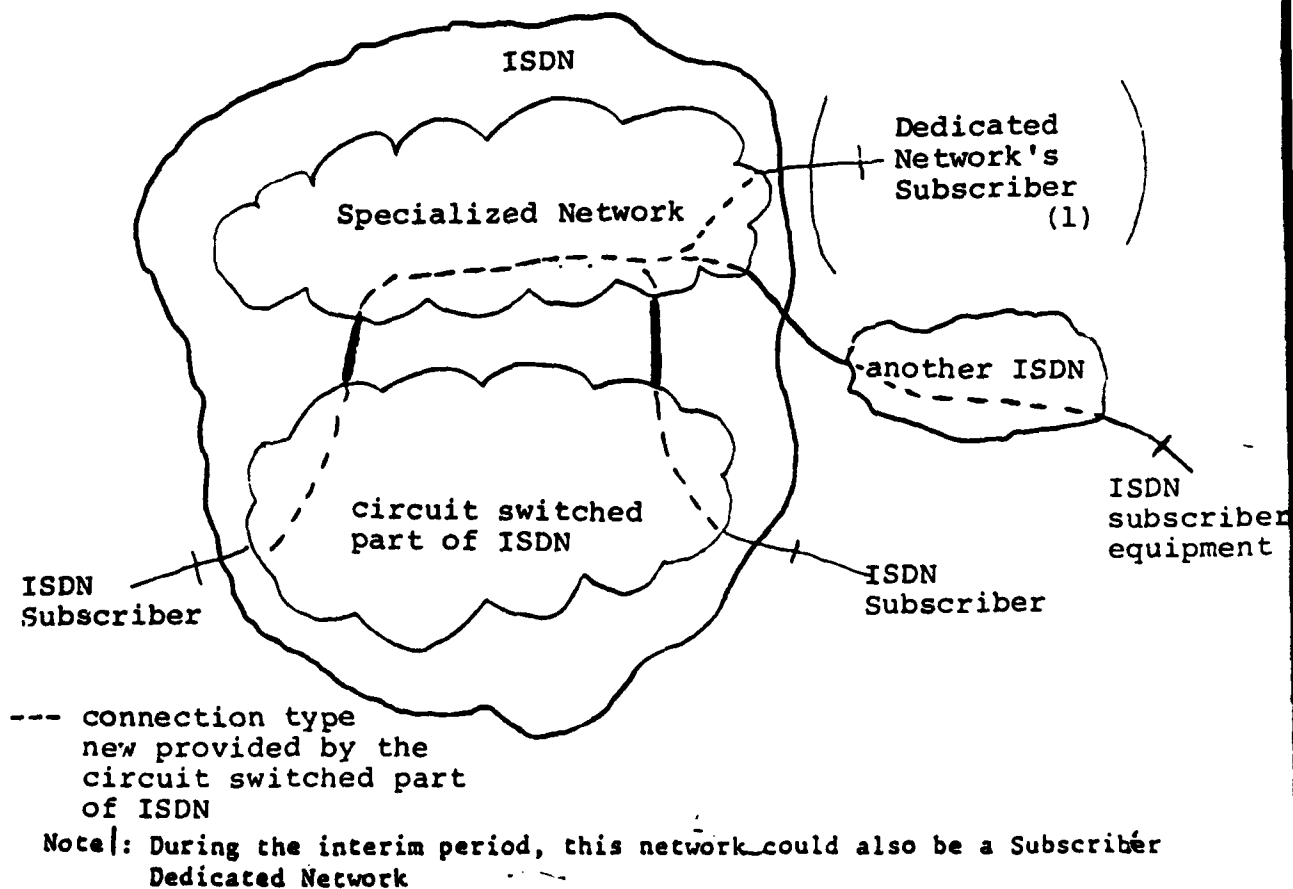
T1 V1 : Interfaces corresponding to basic channel structure
 T22, V22: - " - " - primary rate channel structure
 T23 V23: Interfaces corresponding to a broadband channel structure

Note : All these configurations have not mandatory to be implemented in a given network.

Figure 7/I 0210 - Examples of practical local arrangement



- Fig. 8 / 10210 - Interworking with a specialized network



A.134

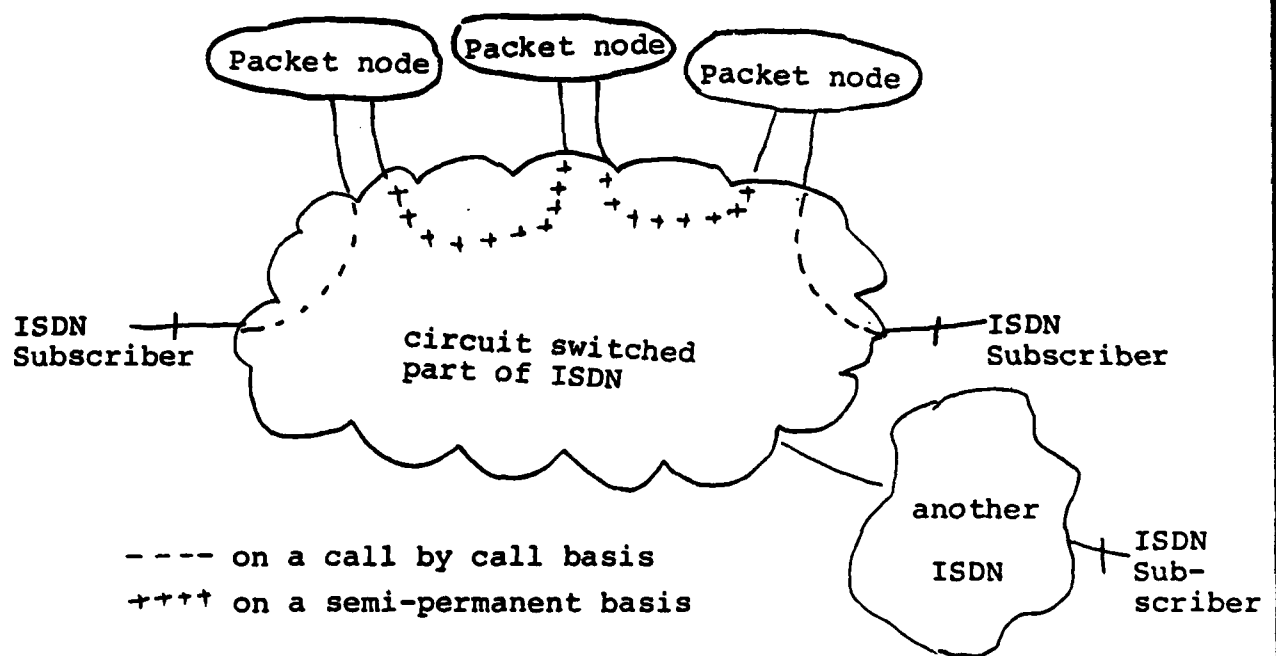
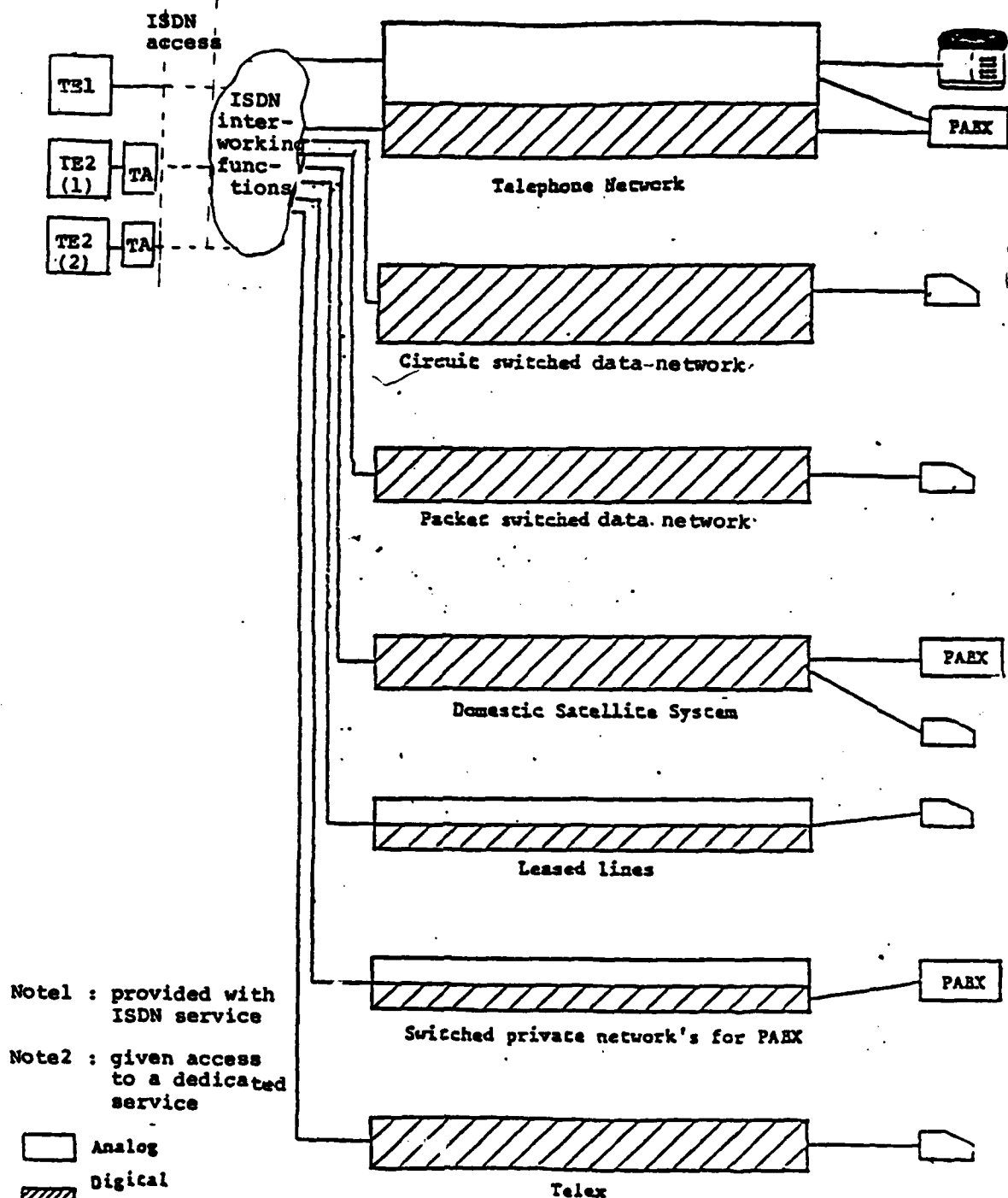


Fig.10/I0210 - Dedicated Logical Packet switching network

A.135

figure 11 / I0210 Interworking



Note1 : provided with ISDN service

Note2 : given access to a dedicated service

Note 1 : Depending on national conditions some of these networks may not exist. Many of them could be partially or wholly integrated. Some of them are not part of the ISDN.

Note 2 : The ISDN interworking functions may be implemented either within the ISDN local exchange or in other part of the network.

ANNEX 4

(to the report of Working Team 3)

Draft Recommendation I.310: *[This will be worked on further in June 83.]*
Numbering and Addressing Principles in ISDN.

1. Introduction

This preliminary draft Recommendation is not intended to be an ISDN numbering plan. Rather, it describes particular requirements and principles which should be observed during the development of the ISDN numbering plan.

2. Principles for international ISDN number to ISDN user/network reference configurations.

2.1 An international ISDN number shall unambiguously identify a particular interface at reference point T, when desired.

2.2. An international ISDN number shall unambiguously identify a particular group of interfaces at reference point T. (e.g., hunt group), when desired.

2.3. An international ISDN number shall unambiguously identify a particular interface at reference point S, when desired. This includes a "virtual interface" at reference point S; e.g. for TA + NT2 configuration.

2.4 An international ISDN number shall unambiguously identify a particular group of interfaces at reference point S. (e.g., hunt group) when desired. This includes a group of "virtual interfaces" at reference point S; e.g. for TA + NT2 configuration.

2.5. An international ISDN number shall unambiguously identify a particular TE (X.200 end system), when desired.

2.6 An international ISDN number shall unambiguously identify a particular group of TEs (X.200 end systems), (e.g., generic fire/police/rescue number), when desired.

2.7 A particular interface, group of interfaces, TE, or group of TEs may be assigned more than one international ISDN number.

2.8 All ISDNs shall be able assign an international ISDN number to an interface at reference point S or T. In addition, some ISDNs may be capable of assigning an international ISDN number to a TE, or group of TEs. For some ISDNs, such a TE may be portable only within the area served by a particular interface, or group of interfaces, at reference point T.

2.9 In the description of a particular protocol, international ISDN numbers may be divided into a number of separate fields for convenience in implementation. These fields may be individually named (e.g., "address", "subaddress", "extension"), but collectively form the international ISDN number, and shall collectively comply with the contents of this recommendation.

2.10 On a particular interface, there may be more than one connection present at a given instant. The international ISDN number does not identify a particular connection.

2.11 Within a particular interface, there may be more than one channel. The international ISDN number does not directly identify a particular channel. Indirect identification of particular channels may occur; e.g., when the international ISDN number identifies a particular interface and there is a one-to-one correspondence between that interface and particular channels.

3. Principles Relating International ISDN Numbers to the X.200 Reference Model.

3.1 Within a particular TE, there may be more than one X.200 physical layer entity, physical layer entity instance, or physical service access point. An international ISDN number does not directly identify a particular X.200 physical layer entity, physical layer entity instance, or physical service access point. Indirect identification of a particular physical layer entity, physical layer entity instance, or physical service access point may occur; e.g., when the international ISDN number identifies a particular interface and there is a one-to-one correspondence between that interface and a physical layer entity instance.

3.2 Within a particular TE, there may be more than one X.200 link layer entity, link layer entity instance or link service access point. An international ISDN number does not directly identify a particular X.200 link layer entity, link layer entity instance, or link service access point. Indirect identification of a particular link layer entity, link layer entity instance, or link service access point may occur; e.g., when the international ISDN number identifies a particular interface and there is a one-to-one correspondence between that interface and a link layer entity instance.

3.3 Within a particular TE, there may be more than one X.200 network layer entity or network layer entity instance. An international ISDN number does not directly identify a particular X.200 network layer entity or network layer entity instance. The relationship between international ISDN number and X.200 network service access points is for further study.

3.4 Within a particular TE, there may be more than one X.200 entity, entity instance, or service access point at transport, session, presentation, and application layers. An international ISDN number does not directly identify a particular X.200 entity, entity instance, or service access point at these layers.

3.5 Within a particular TE, there may be more than one application process. An international ISDN number does not directly identify a particular application process.

A.138

4. Relationship between international ISDN number, user-indicated routing, service indication, and quality of service indication.

4.1 The international ISDN number does not provide the means for a user to affect routing. Therefore, signalling procedures shall be capable of carrying user-indicated routing information (e.g. RPOA selection) separately from the international ISDN number.

4.2 The international ISDN number does not identify the particular nature of the service to be used, or

of the type of connection to be used.

As an objective, separate international ISDN numbers shall not be assigned solely to identify the service to be provided (but such arrangements could be used at early stages for interworking with some dedicated bearer service networks; e.g. PSTN). Therefore, the signalling procedures shall be capable of carrying service identification codes.

4.3 The international ISDN number does not identify the particular quality of service to be used. Therefore, the signalling procedures shall be capable carrying quality of service identification codes.

4.4 Routing of ISDN connections shall take into account the following information, when supplied by the user:

- a) international ISDN numbers;
- b) service identification codes;
- c) quality of service identification codes;
- d) user-indicated routing information, when an

On a particular connection, the user may choose to supply some, all, or none of this information. Nevertheless, the user shall be allowed to fully specify all of these items during the initial connection establishment signalling procedure.

4.5 A particular ISDN may not be capable of accomodating some of the information identified in section 4.4. However, such an ISDN shall be capable of transparently conveying any such information for use by other networks.

(NOTE: One administration objected to this requirement for transparent conveyance of user-indicated routing information. Urgent study is required to confirm or deny, during this study period, the need for all ISDNs to convey user-indicated routing information, even if a particular ISDN does not accomodate such information.)

4.6 In the case where an international ISDN number identifies a mobile TE, or a TE served by several interfaces or networks, the network may need to map from the international ISDN number into a specific interface designation.

5. International ISDN Number Design Considerations.

5.1 There may be a number of public ISDNs in a country*. There may be a number of private ISDNs in a country*.

5.2 When a number of public ISDNs exist in a country*, it shall not be mandatory to integrate the numbering plans of the ISDNs. When a number of private networks exist in a country*, it shall not be mandatory to integrate the numbering plans of the private networks, but these private network numbers shall be aligned with the principles of this Recommendation.

5.3 The international ISDN number shall include an unambiguous identification of a particular country or geographic area.

The choice of country code between TCC and DCC is for urgent future study.

NOTE: The principles for evolution from existing numbering plans, and for interworking with dedicated bearer service networks, must be developed in order to achieve this objective. (See Annex A)

5.4 An existing numbering plan (such as E.163 or X.121) may coexist with the ISDN numbering plan in an ISDN; however, as an objective, all ISDNs should evolve towards using a single numbering plan. See Annex A for a proposed set of interworking and evolution principles to be studied.

5.5 The international ISDN number shall include an unambiguously identification of a particular geographic area within a country (or geographic area), when desired.

5.6 The international ISDN number shall include an unambiguous identification of a particular network (public/private, ISDN/dedicated bearer service) within a country (or geographic area), when desired. For a private network which spans more than one country (or geographic area), the country code will cause delivery of a call to the particular private network in the specified country (or geographic area).

NOTE: The need for this network identification to be a fixed size for all public networks is for further study.

5.7 The international ISDN number shall be capable of containing without change, the national number of a public dedicated bearer service network, when desired.

5.8 The international ISDN number shall be capable of providing for interworking of TEs on ISDNs with "TEs" on other networks (public/private, ISDN/dedicated bearer service), when desired. However, other means of interworking could be employed in some countries if TEs in one country using one type of procedure on one network can successfully interwork with TEs in other countries using other types of procedures on other networks.

5.9 When there is more than one interface between a private network and a public ISDN entry point, it is for further study whether the identity of each private network TE may be associated with a specific entry point.

* or geographic area

2
5.10² The international ISDN number shall be capable of unambiguously identifying a particular mobil interface or TE, TEs, when desired.

6. Structure of International ISDN Numbers.

6.1 The number of digits in the international ISDN number shall be governed by national and international requirements. A reasonable limit on the overall number of digits shall be imposed.

6.2 The international ISDN number shall provide substantial spare capacity to accommodate future requirements.

6.3 The international ISDN number shall be a sequence of decimal digits.

6.4 The international ISDN number may be of variable length. The minimum length shall be ___ digits (tentatively 4 digits). The maximum length shall be ___ digits. These lengths do not include prefixes, escape codes, etc., since these items are not considered part of the international ISDN number.

NOTE: The actual maximum length is for further study, but shall be at least 14 digits.

6.5 The exact encoding of the international ISDN need not be the same for all protocols, or throughout all ISDNs, even for a particular call. Some examples of encoding methods are: BCD quartets, IAS characters, binary mapping from alphabetic characters to digits.

6.6 The representation of an international ISDN number at the person-machine interface may include alternative forms, in addition to decimal digits; e.g. abbreviated numbers. However representation as a sequence of decimal digits shall be universally allowed.

6.7 At the person-machine interface, the need for a

prefix to distinguish between abbreviated and complete representations of an international ISDN number is for further study. If such prefixes are required, internationally recommended values will be chosen.

6.8 The need for an escape code to distinguish between an international ISDN number and a number from another numbering plan is for further study. If such escape codes are required internationally recommended values will be chosen.

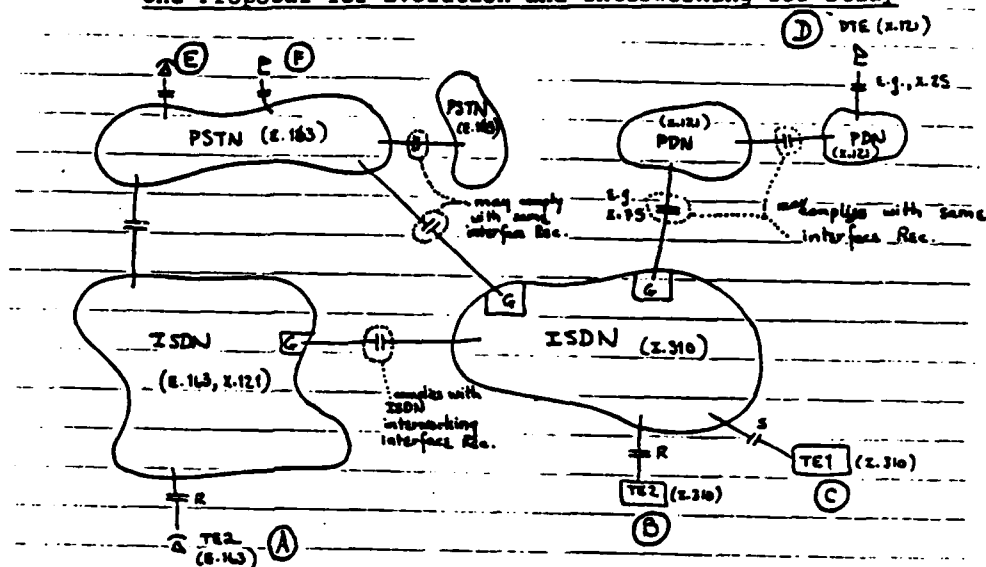
6.9 For machine-machine protocols across ISDN interfaces, the need to convey international ISDN numbers in partial form (e.g., national number only) is for further study.

6.10 The international ISDN number shall be structured as follows:

for further study.

ANNEX A :

TD65

One Proposal for Evolution and Interworking for StudyLEGEND :

ISDN () - an ISDN using the numbering plan principles specified in parentheses.

TE 2 - a TE2 whose interface is numbered according to the numbering plan specified in parentheses

△ - telephone
▽ - data terminal

1. At an interface between an ISDN and dedicated bearer service network, the ISDN gateway will convert between international ISDN numbers and dedicated bearer service network numbers, when required.
2. ISDN - ISDN interfaces always use international ISDN numbers. An ISDN may (when it has no interfaces at reference point S or T assigned international ISDN numbers and has no TE's assigned international ISDN numbers). Use only numbers from dedicated bearer service numbering plans. Such an ISDN is responsible for any conversion of international ISDN numbers.
3. TE1s are always allowed to use international ISDN numbers. Some ISDNs may also allow other numbers to be used; e.g., with an escape code.
4. When a TE2 calls an existing dedicated bearer service network user, the TE2 may use the dedicated bearer service number. If necessary, the TA will convert this number into a format of the ISDN numbering plan; i.e., when that ISDN only uses the ISDN numbering plan.
5. When a terminal on a dedicated bearer service network calls an ISDN TE/interface which has been assigned an international ISDN number, that terminal must use the appropriate dedicated bearer service procedure for indicating the international ISDN number.

A.142

ANNEX 5

(to the report of Working Team 3)

DRAFT RECOMMENDATION I 0220 ISDN PROTOCOL REFERENCE MODEL

Considering that:

- the ISDN concept is described in Rec. G705
- the ISDN services are described in draft Rec. I 0100
- the ISDN architecture functional model is described in draft Rec. I 0230
- the ISDN connection types are described in draft Rec. I 021X
- a means of describing the interchange of information between ISDN user and network elements and between network elements is required,

an ISDN Protocol Reference Model has been developed. This model is used as the basis for a set of ISDN protocol reference configurations which may be encountered over an ISDN.

A layered structure approach based on the Reference Model of Open Systems Interconnection (OSI) for CCITT Applications (Provisional Rec. X 200) is used to formulate the ISDN Protocol Reference Model described herein.

The scope of application of the ISDN Protocol Reference Model is as illustrated in Figure 1. This refers to the communication and control aspects between an ISDN user terminal equipment (TE) and;

- another ISDN user terminal equipment
 - some network control facilities inside the network
 - some information processing/messaging facilities.
- These facilities may reside within the network, or outside the network.

The ISDN Protocol Reference Model is a generic, logical representation of all types of communications and control envisaged in Figure 1. No implementation aspects are in any way implied in the ISDN Protocol Reference Model and the applications illustrated in this draft Recommendations.

1. MODELLING CONCEPTS

In order to describe the ISDN Protocol Reference Model, a

fundamental generic modelling block has been identified. Such a building block can be used to describe various elements in the ISDN user premises and the network (e.g. Terminal Equipment (TE), Network Termination (NT), Exchange Termination (ET), Signalling Point (SP) and Signalling Transfer Point (STP), etc.)

1.1 Information Functional Groupings

Figure 2 illustrates the conceptual aspects of the fundamental building block. A three-dimensional representative is used to describe three types of information functional groupings, namely,

- U information functional grouping
- S information functional grouping
- M information functional grouping

- o U information functional grouping represents generically the user information (e.g. digitized voice, data and other services). This information may be transmitted transparently. It may be also be processed or manipulated. Examples of this latter group include data which is stored or encrypted within the network.

A seven-layer structure consistent with CCITT Recommendation X. 200 is used to describe the various activities associated with the U functional grouping.

- o S information functional grouping represents generically the signalling information. This information refers to all^s signalling and control aspects related to user-to-exchange connection control (set-up, monitoring and clear down), non-connection related control, control of transfer of user information, access to network control facilities, user-to-user signalling, etc.

The above distinction is made in order to treat all signalling and control aspects within one functional grouping in a unified fashion. It is noted that in some cases (e.g. in Rec. X.25 for packet-mode access interface) this distinction is not explicitly made. However, in the ISDN context, such a generic distinction is important in the development of an ISDN Protocol Reference Model. Two types of signalling have been identified, namely,

- In-band (or in-slot) signalling (e.g. X.21, X.25)
- Out-band (or out-slot) signalling (e.g. Common Channel Signalling System No. 7, signalling in the D channel)

Both above aspects can be represented in the fundamental building block in Figure 2. Interworking aspects between different signalling schemes of the same type and between signalling schemes of different types can also be catered for.

For the reasons described above, the S information functional grouping is represented by seven OSI layers. As described in Section 2, the ISDN Protocol Reference Model incorporates all the seven layers. However for various examples of applications illustrated in Section 3, two different approaches will be used, where appropriate, one using all seven layers and one using only the three lower layers for signalling to the network. In the latter case, the top 4 layers would be used for user-to-user signalling concurrently with user-to-exchange signalling in the lower 3 layers.

It was not possible to reach agreement on a single approach in the time available.

M information functional grouping represents generically all the local (e.g. terminal) management aspects associated with the transfer of user information and signalling/control information. It is responsible for the management functions associated with the other two information functional groupings U and S. Examples of these functions include the selection of appropriate responses to connection failure and other exception conditions occurring over the communication facility. These functions, also include "network management" and traffic control to optimize utilization of network resources. Such network management information when transmitted to another location is treated as information in either U or S functional groupings, or both, as appropriate.

(Note: The M information functional grouping is not partitioned into OSI layers at this stage. Such partitioning may not be appropriate for SG XVIII and is anyway for further study. Comments from other interested parties in particular Study Group VII are requested).

1.2 Interactions Between Information Functional Groupings

All interactions between U and S information functional groupings whether at a given layer or across different layers normally take place via the M information functional grouping. Exceptions include the interactions between U and S layers 4 - 7 (Transport, Session, Presentation, Application). At layers 4 - 7, the U and S groupings may have their own protocol functions. They may also share common resources. This aspect is therefore illustrated by a dotted line in Figure 2.

(e.g. Basic Access)

At layer 1, in some applications (e.g. Basic Access) the functions (e.g. TDM, bit synchronization, loopback activities) are shared by both U and S functional groupings. In other applications (e.g. PABX Access), these functions may be separate for U and S groupings.

1.3 External Interactions of Fundamental Building Block

Apart from layer protocols associated with the U and S functional groupings of one fundamental building block and those of another block, external interactions at the upper and lower faces of a building block are not part of the ISDN Protocol Reference Model. These are subjected to other CCITT Recommendations where applicable. However, for the purpose of this Draft Recommendation I 0220, they are illustrated in Figure 3 as follows:

- Physical transfer of information (whether user or signalling/control) between one fundamental building block and another takes place over the physical media attached to both U and S information functional groups. In some applications, (e.g. ISDN basic access), a common physical medium may be shared by both U and S groupings.
- Interactions at the upper face of the building block to various application processes external to the block. These include system (or block) management, user applications, signalling applications.

2. ISDN PROTOCOL REFERENCE MODEL

From the fundamental modelling concepts described in Section 1, an ISDN Protocol Reference Model has been developed as illustrated in Fig. 4. From the standpoint of modelling the various network elements such as network control facilities, information processing/messaging facilities as shown in Figure 1 can be treated in the same manner as a user system such as a terminal equipment (TE).

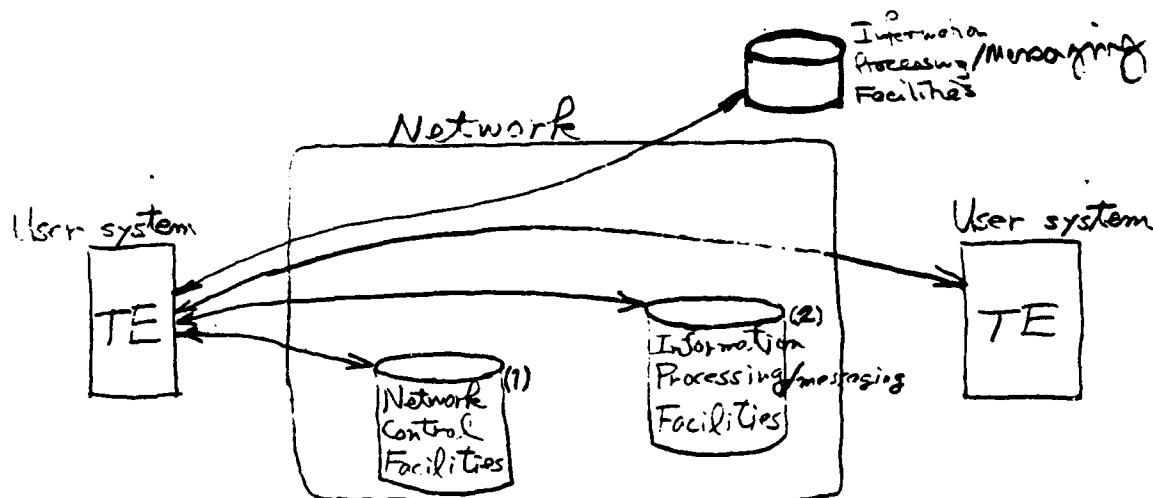
The access between the customer equipment and the network is represented by the S/T reference plane (cf. S/T reference point in the ISDN user/Network Reference Configuration as described in Draft Rec I...)

For network elements such as exchanges, signalling points (SP), signalling transfer points (STP), a mirror image version of the fundamental building block is used. This representation allows peer-to-peer protocols inside the network as well as ISDN User/Network access to be taken into account. Note however, for clarity these peer-to-peer protocols are not shown in Fig.4.

3. EXAMPLES OF APPLICATIONS OF THE ISDN PROTOCOL REFERENCE MODEL

Figures 5 - 10 illustrate a number of applications of the above ISDN Protocol Reference Model (More text will be provided later for the Geneva SG XVIII meeting (June - July 1983)).

4. FURTHER STUDY (To be provided)



- Note (1) Network control facilities perform such functions as, for example, closed user group registration. These are owned by network operators.
- (2) Information processing/messaging facilities include data base facilities. These may or may not be owned by network operators.

Fig. 1 REFERENCE CONFIGURATION FOR ISDN COMMUNICATIONS

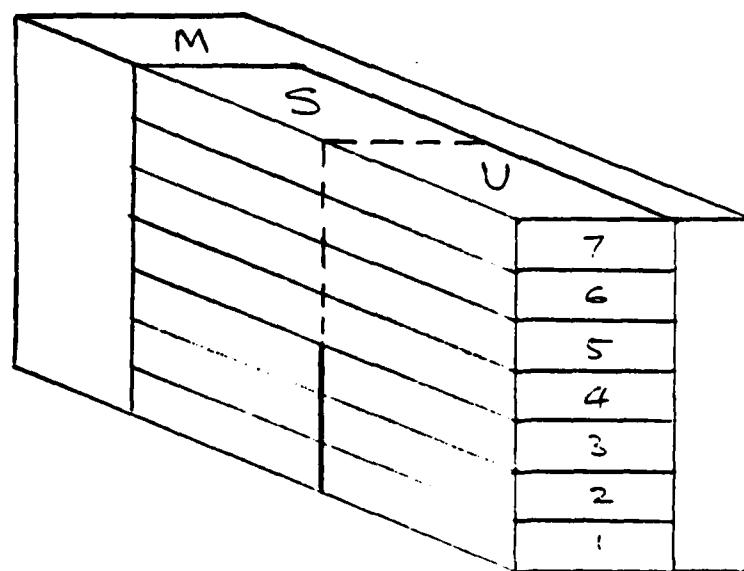


Fig. 2 CONCEPTUAL STRUCTURE OF THE FUNDAMENTAL PROTOCOL BUILDING BLOCK

- U: User information functional grouping
- S: Signalling information functional grouping
- M: Management information functional grouping

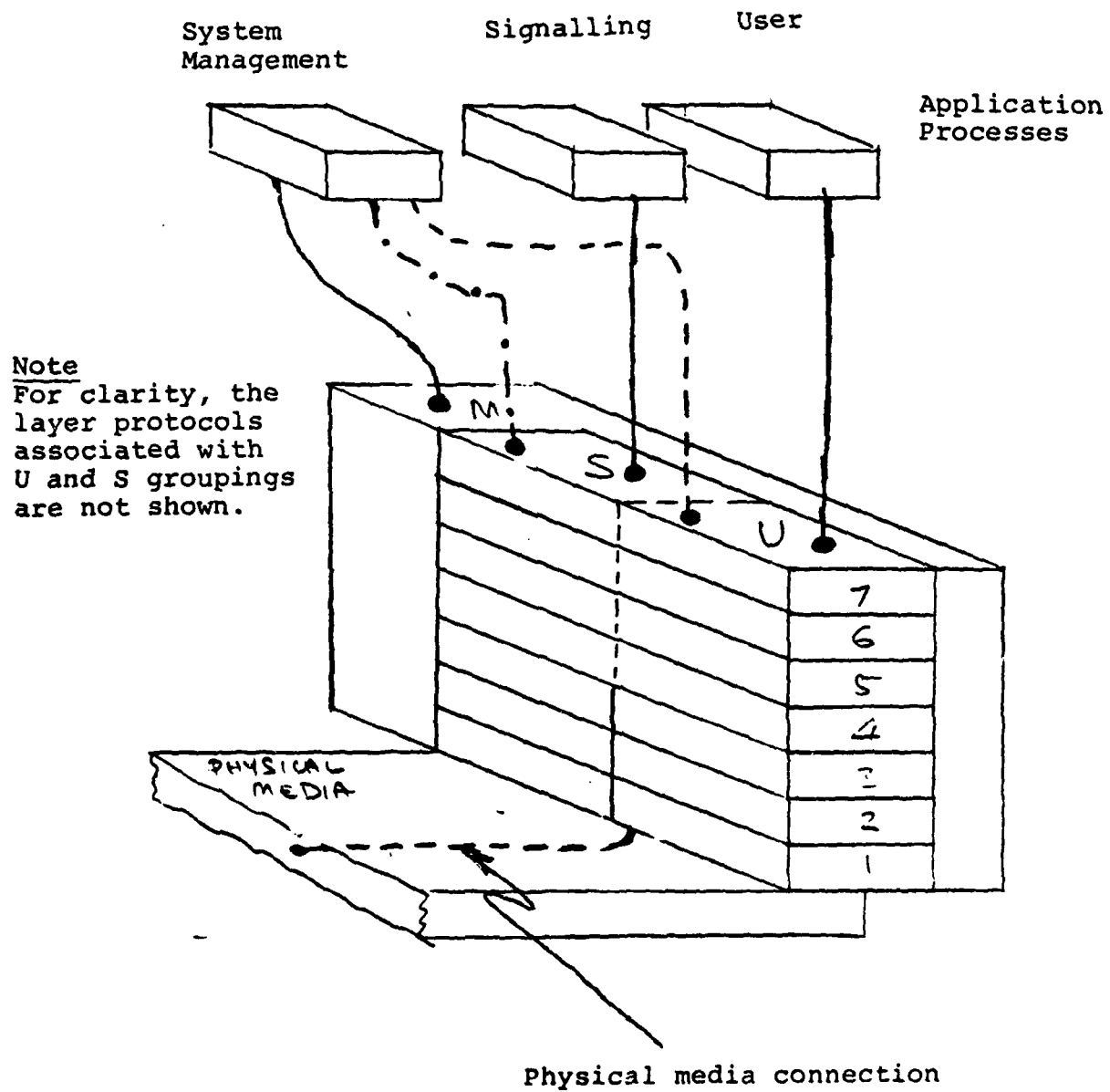


Fig. 3 EXTERNAL INTERACTIONS ASSOCIATED WITH A FUNDAMENTAL BUILDING BLOCK

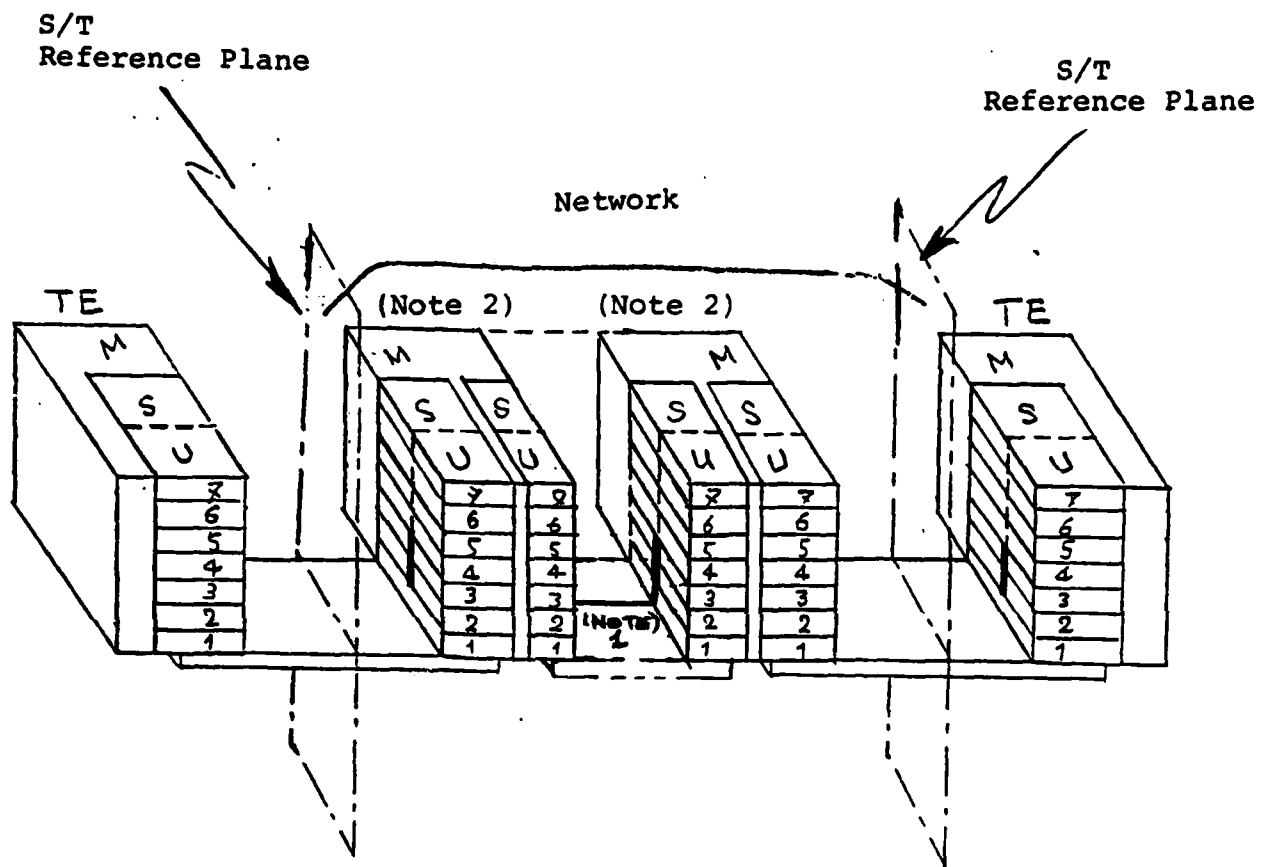


Fig. 4 ISDN PROTOCOL REFERENCE MODEL

Note 1: Within the network, different physical media connections may be used between fundamental building blocks (e.g. exchanges, Signalling Points, Signalling Transfer Points.)

Note 2: For network elements that perform relaying functions (such as switching exchanges, signalling transfer points), the U information functional grouping is represented by the lower three layers only. For network elements that perform end-systems functions (such as those providing information processing/messaging facilities), all the seven layers are represented.

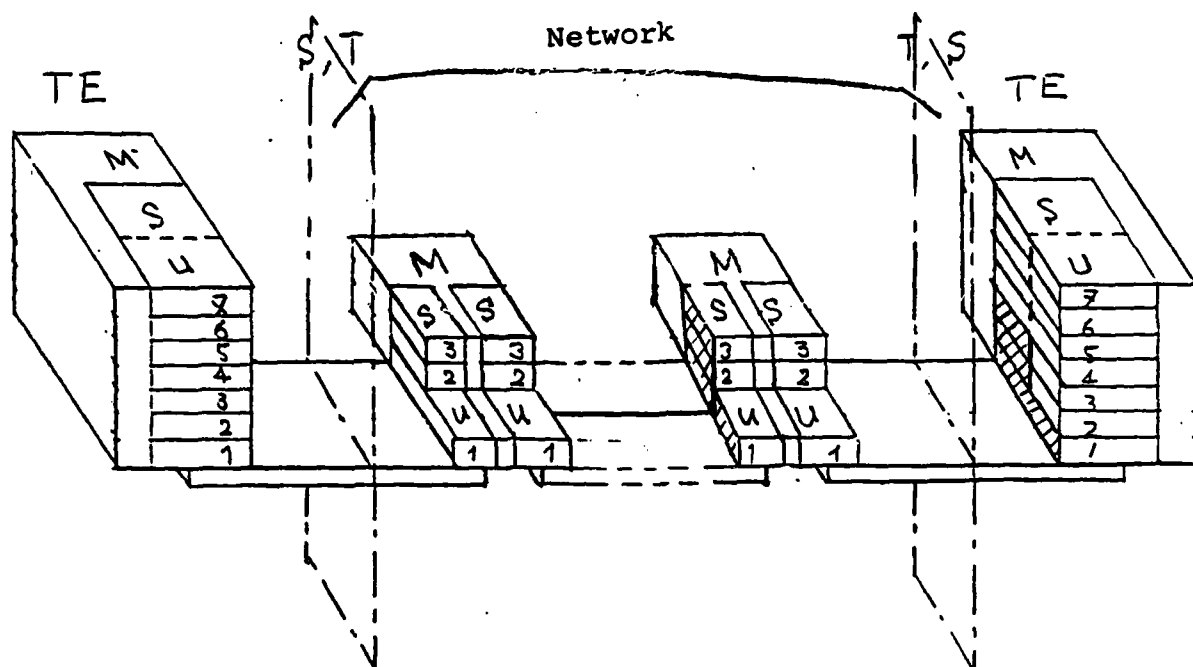


Fig. 5A ISDN PROTOCOL REFERENCE CONFIGURATION
FOR CIRCUIT-SWITCHED CONNECTION
(THREE-LAYER APPROACH USED)

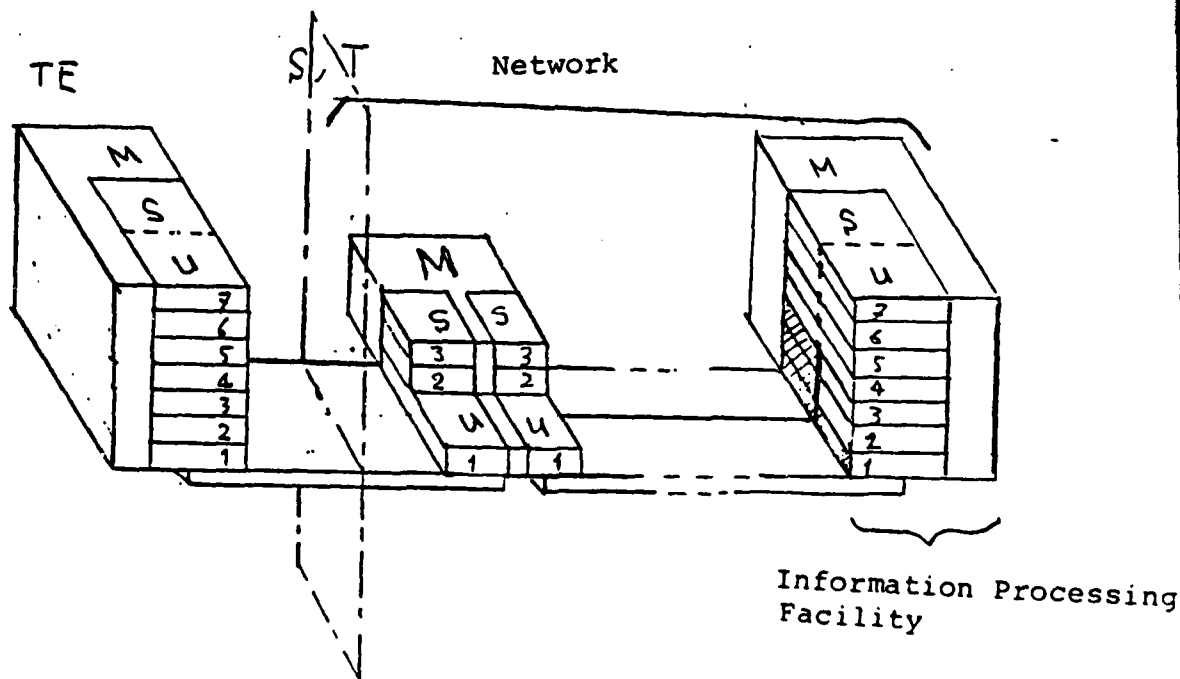


Fig. 5B ISDN PROTOCOL REFERENCE CONFIGURATION
FOR CIRCUIT-SWITCHED ACCESS TO HIGHER
LEVEL FUNCTIONS
(THREE-LAYER APPROACH USED)

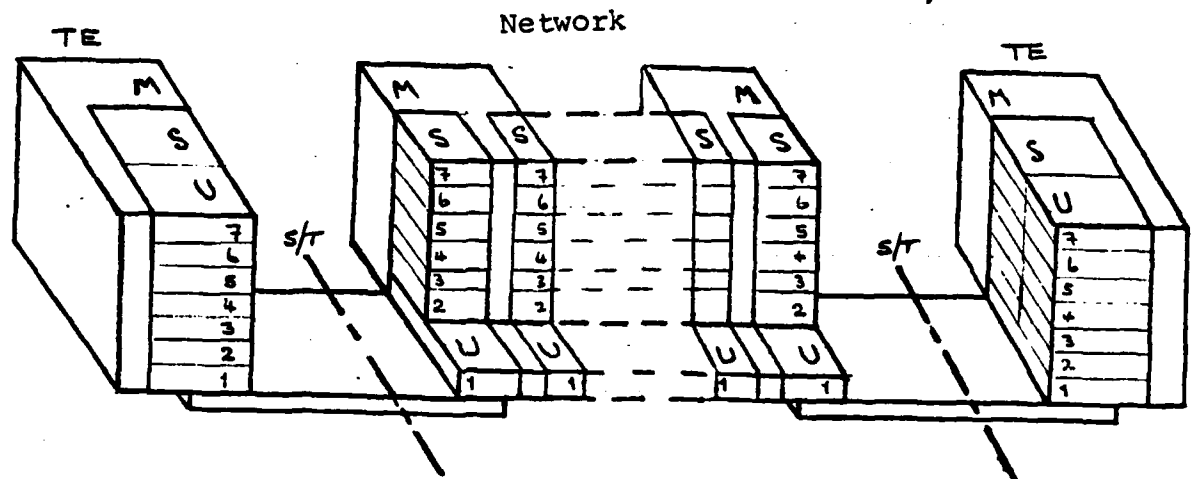


Fig. 5Abis ISDN PROTOCOL REFERENCE CONFIGURATION
FOR CIRCUIT-SWITCHED CONNECTION
(Seven-layer approach used)

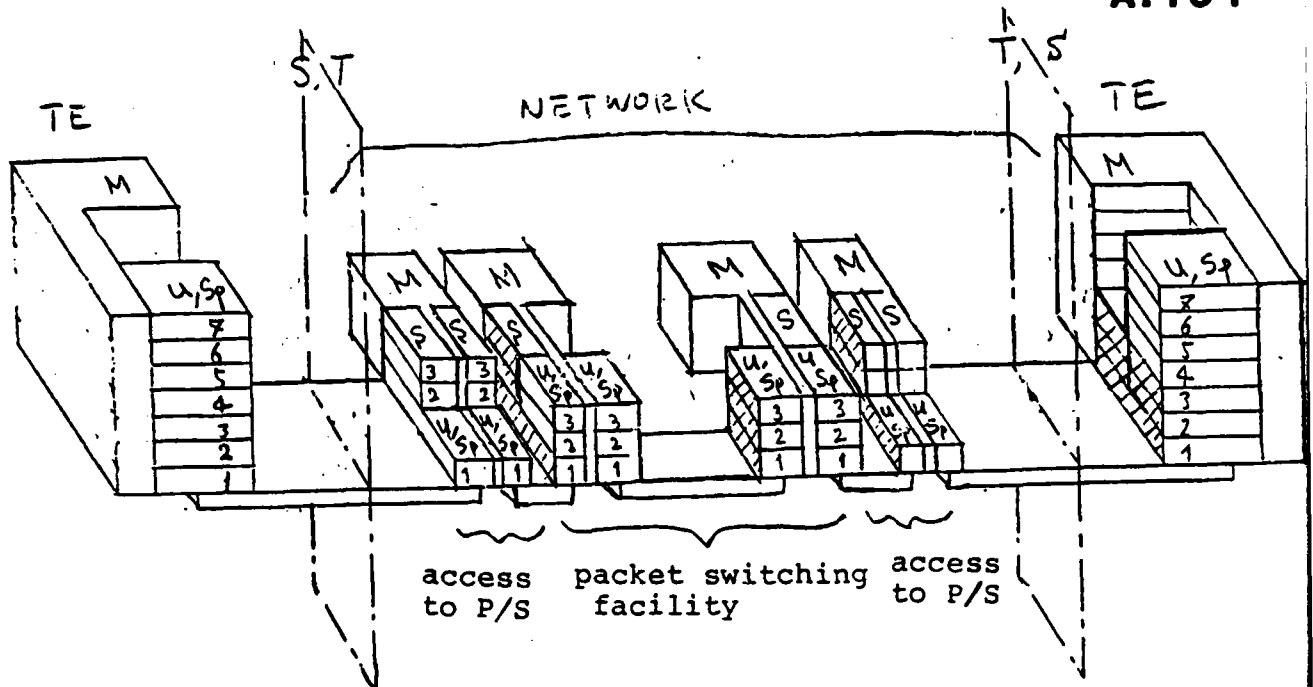


Fig. 6A ISDN PROTOCOL REFERENCE CONFIGURATION
(BASIC CONNECTION - P/S via B-channel)

FOR PACKET-SWITCHED CONNECTION VIA B-CHANNEL
(THREE-LAYER STRUCTURE USED.)

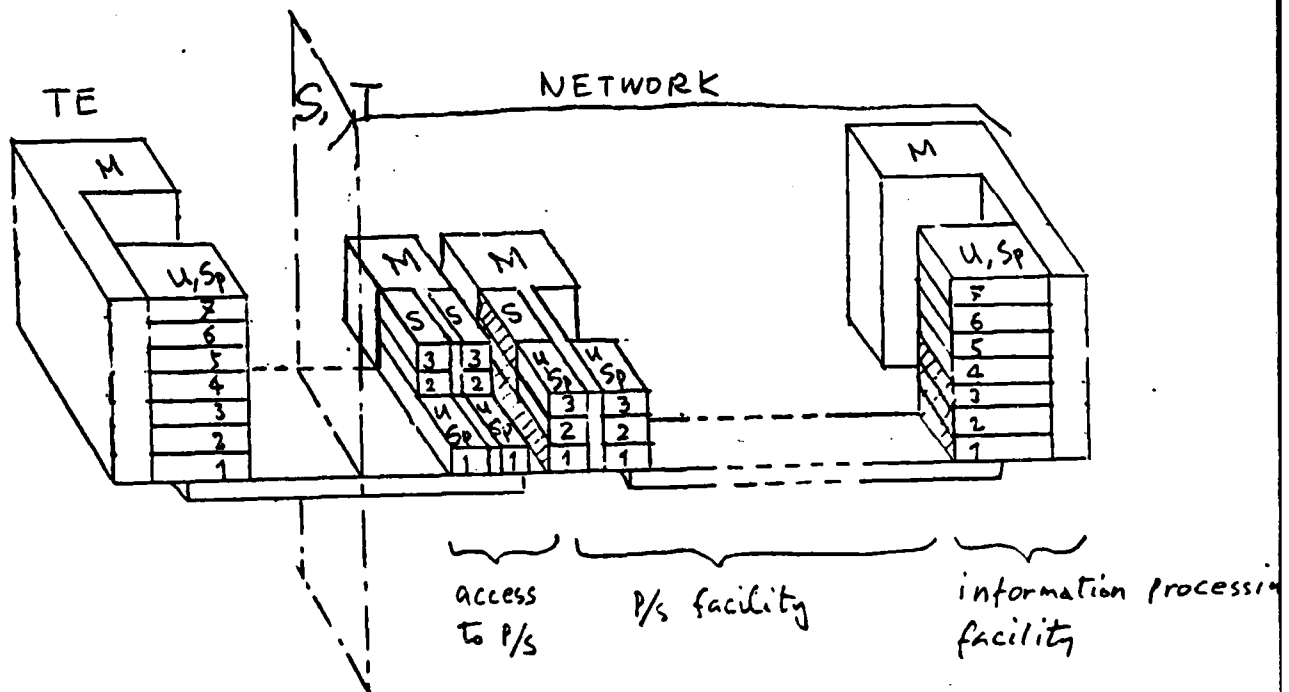


Fig. 6B ISDN Protocol Reference Configuration

(Access to HLF - P/S via B-channel)

FOR PACKET-SWITCHED ACCESS TO HIGHER
LAYER FUNCTIONS VIA B-CHANNEL
(THREE-LAYER STRUCTURE USED.)

A.152

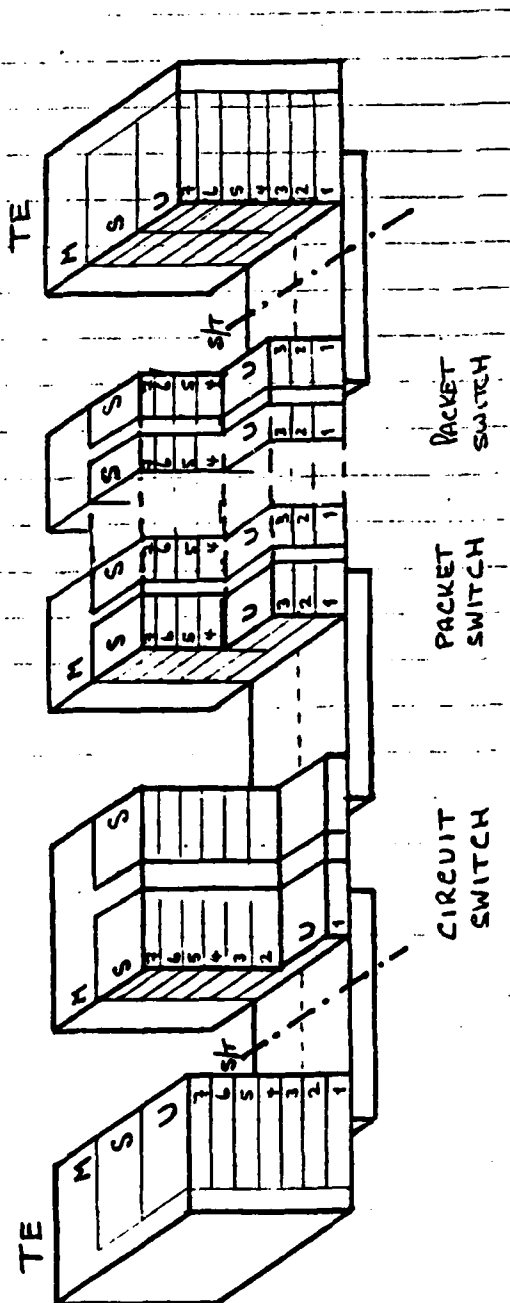


Fig. 6A Bis ISDN PROTOCOL REFERENCE CONFIGURATION
FOR PACKET-SWITCHED CONNECTION VIA D-CHANNEL
(Seven-layer approach used)

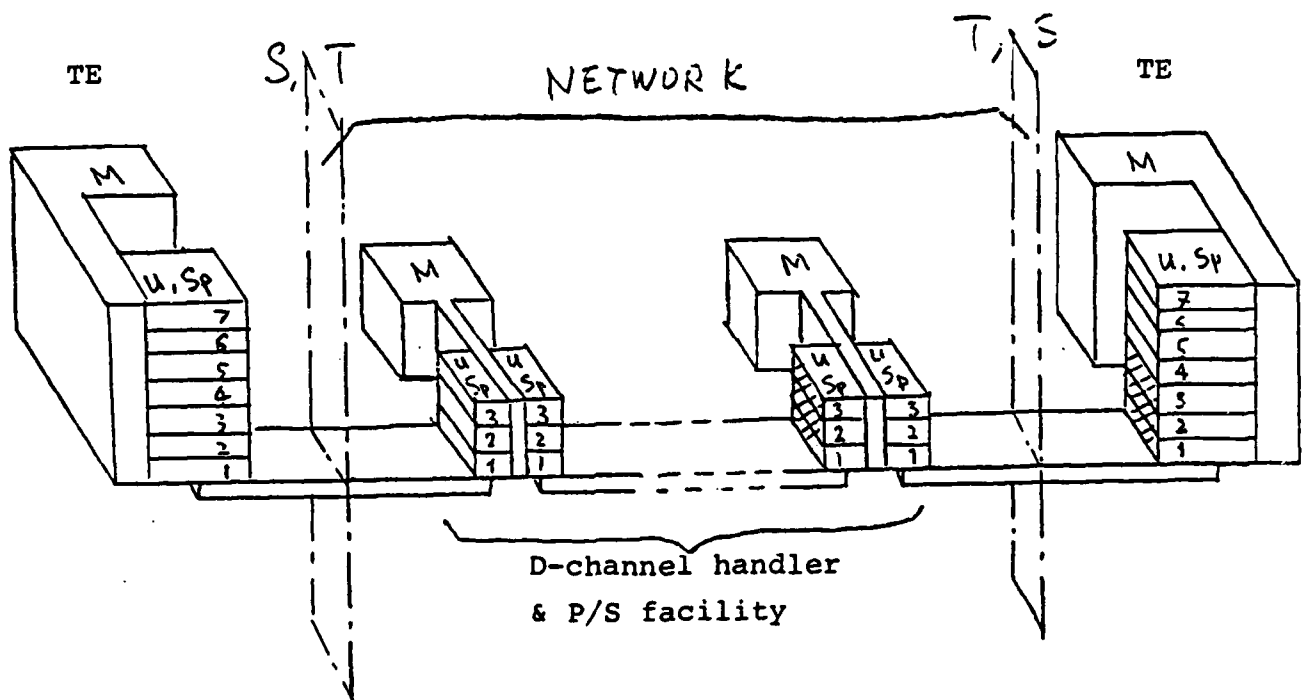


Fig. 7A ISDN Protocol Reference Configuration
FOR PACKET-SWITCHED CONNECTION
VIA D-CHANNEL (THREE-LAYER APPROACH USED.)

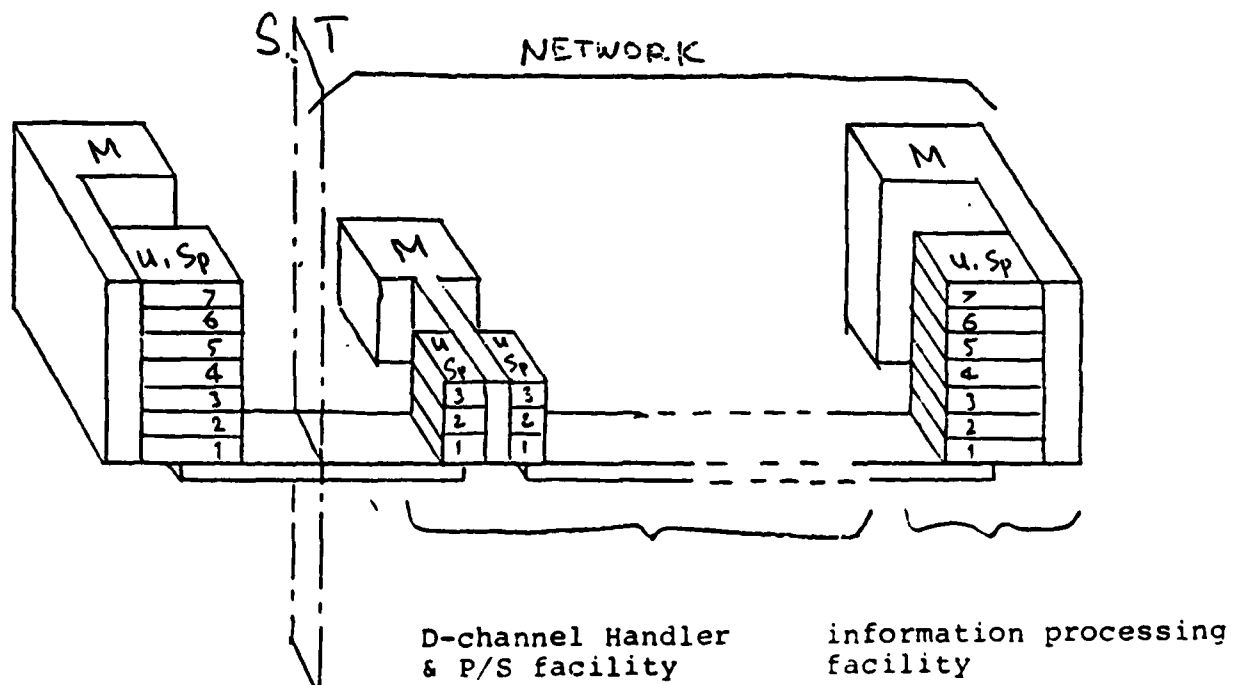


Fig. 7B ISDN Protocol Reference Configuration
FOR PACKET-SWITCHED ACCESS TO HIGHER
LAYER FUNCTIONS VIA D-CHANNEL
(THREE-LAYER APPROACH USED.)

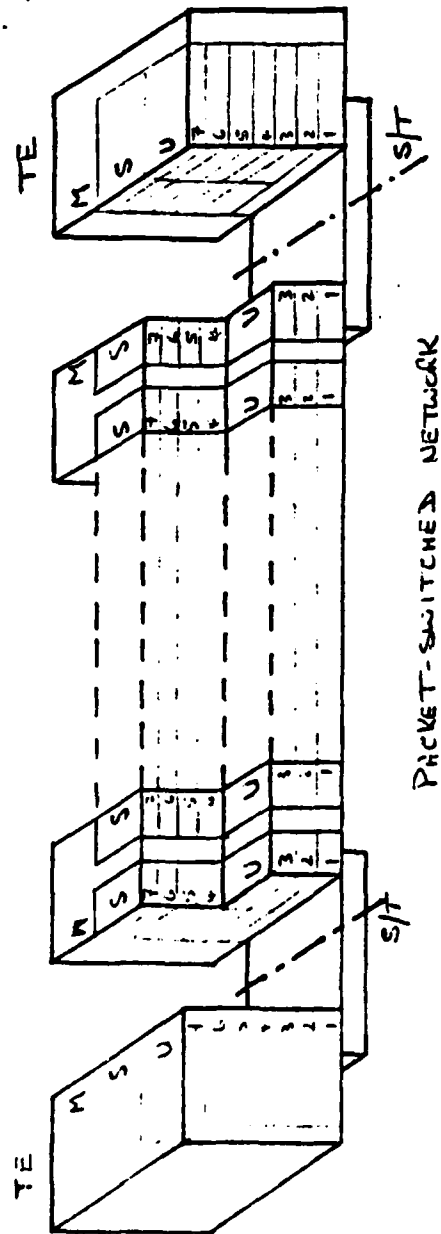


Fig. 7A Bis ISDN PROTOCOL REFERENCE MODEL
FOR PACKET-SWITCHED CONNECTION
VIA B-CHANNEL
(Seven-layered approach used)

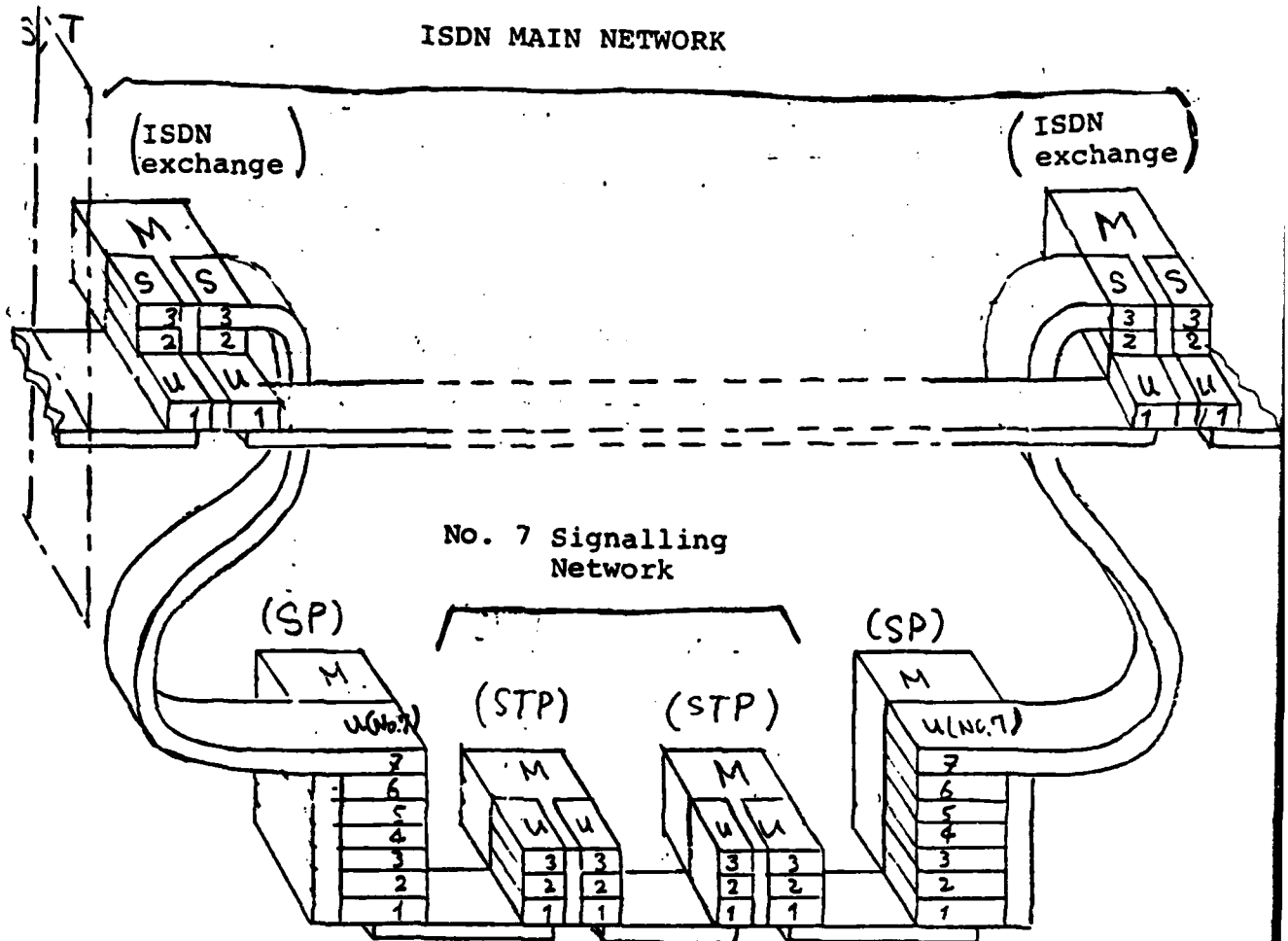


Fig. 8 Relationship between ISDN and No. 7 Signalling Network

(three-layer approach used)

Note: The seven-layer approach maps the seven layers of user/network signalling to the seven layers of the inter-exchange signalling network.

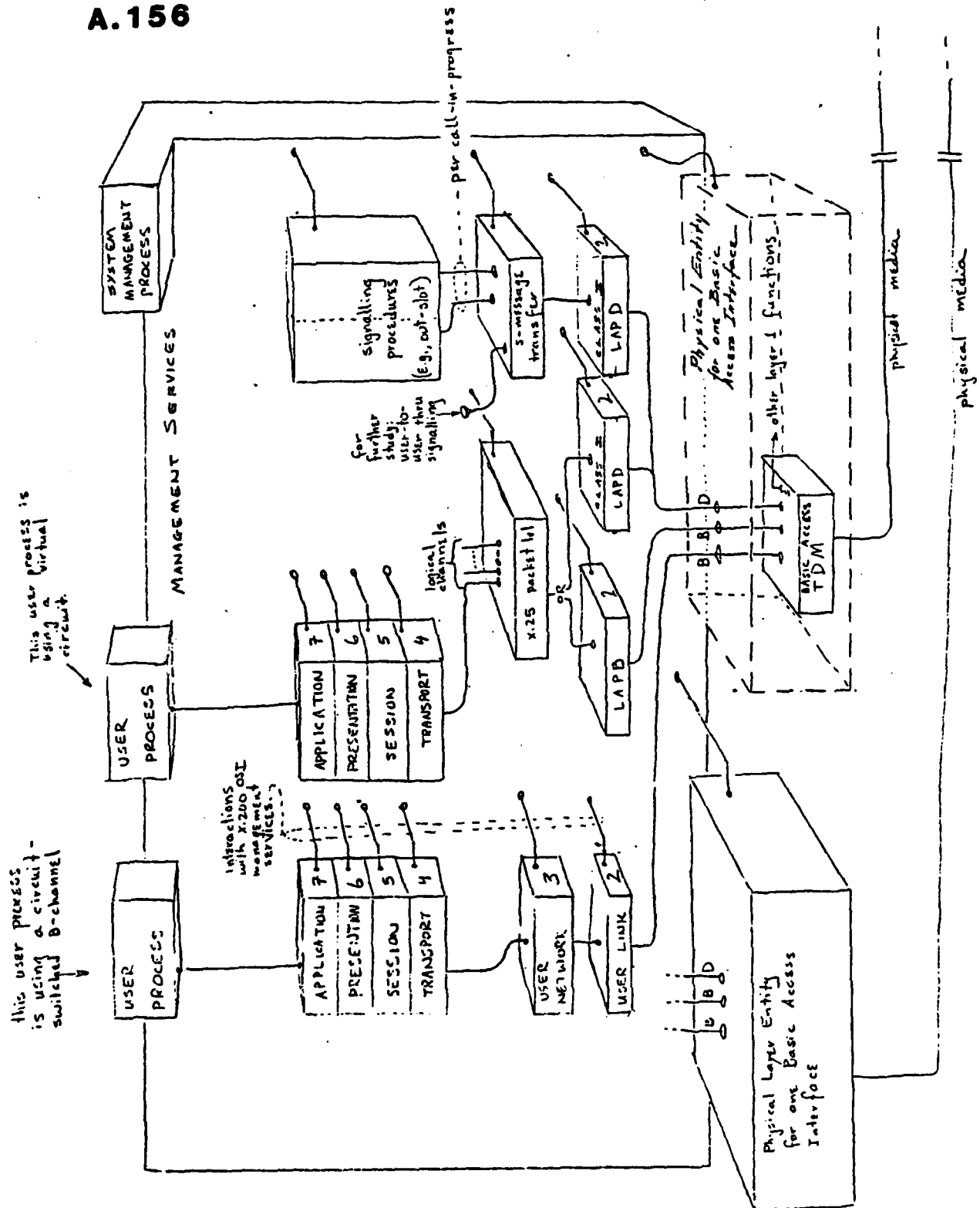


Fig. 9 EXAMPLE OF A TE

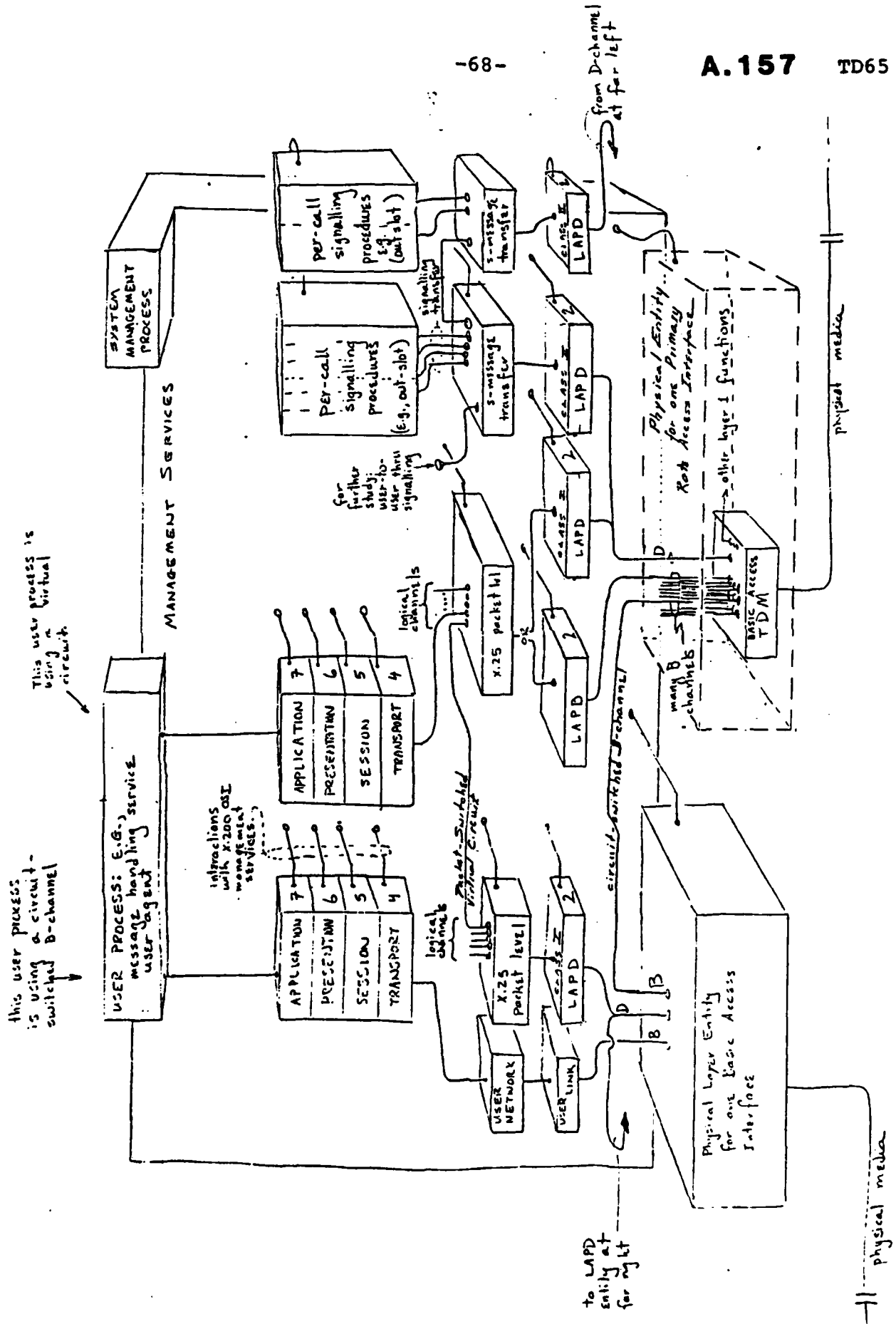


Fig. 10. EXAMPLE OF A NT2. An ET may be viewed similarly.

ANNEX 6

(to the report of Working Team 3)

Suggested Reply to SG II (ref Com XVIII/136)(Routing)

The attention of SG II is drawn to the following draft recommendations.

- I 0210 - ISDN Architecture Functional Model
- I 0310 - ISDN Numbering & addressing principles

The attention of SG II is also drawn to the attached figure 1 from the SG VII report (fig.1.TD.5).

The objective of SG XVIII in drawing these documents to SG II is to identify to SG II the increasing complexity in routing arrangement as networks progress towards the ISDN. Figure 1 from SG VII report directs current complexity in data network routing plans. SG XVIII suggests that the current routing plan for telephony may not be sufficiently flexible for the ISDN.

The view of SG XVIII is that network routing and numbering are closely associated. It is the view of SG XVIII that priority should be placed on development of an ISDN numbering plan.

*Reply will state that further work
must be done by SG XV in Geneva
in June 1984.*

(to the REPORT OF WT3)
Maintenance functions

(Contribution from Sweden)

Maintenance procedures can be divided into the following mainparts:

- Continuous supervision, automatic tests, quality measurements and fault detection
- Failure localization
- Failure evaluation
- Recovery procedures

The interworking between these activities are shown in figure 2.

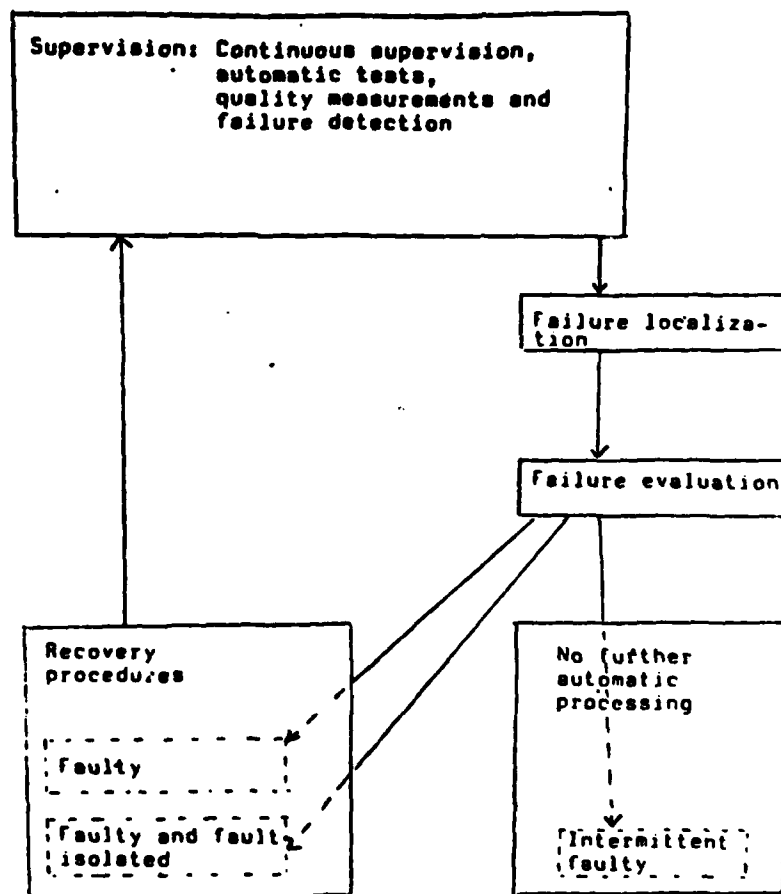


Figure 2 Automatic maintenance procedures

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ANNEX7-2

2 SUPERVISION

2.1 Continuous supervision

Continuous supervision implies that a function is supervised every time it is performed and also that the function is performed in the course of normal digital customer access handling. Functions like line synchronization and data flow in accordance to selected transport service should be supervised in this sense.

2.2 Automatic tests

In the inactive state not many continuously supervised functions are performed. To guarantee a reasonable level of functional reliability to subscribers not using their terminals regularly, an automatic routine test is necessary. Automatic routine test may be based on BER-measurments (BER=Bit Error Rate) from the exchange using controlled data loops.

2.3 Quality measurments

To provide a base for quality classifications, long term BER-measurments are recommended.

2.4 Failure detection

The failure detection procedures are evaluating the disturbance detected by the procedures described in 2.1 and 2.3 and putting the function together with its associated hardware in either of the categories:

- Acceptable.
- Not acceptable.

The pattern of disturbance are not acceptable from at functional point of view.

3 FAILURE LOCALIZATION

Its task is to localize the source causing the disturbances within limits acceptable from an administration point of view (reasonable maintenance organization, failure closing by a single visit etc). The target is to point out faulty DCA and whether the fault is located in the exchange, on the line or at the subscriber side. If the latter, it should also be possible to distinguish between fault in administration installed equipment and subscriber-owned. It is important that the alarm message includes as few replaceable modules (repair points) as possible.

4. FAILURE EVALUATION

The task for the fault evaluation procedures is to place the faulty DCA in either of the categories:

- Faulty.

No restriction regarding traffic is imposed.
Recovery attempts are made.

- Faulty and faultisolated.

Power is switched off. Recovery attempts are made.

- Intermittent faulty.

Depending on the frequency, either no restrictions regarding traffic is imposed or power is switched off. No recovery attempts are made.

Note: As a DCA has no redundancy, the need for the first category is obvious. The second category is for protection of not faulty DCA and or the exchange while the third is also an indication for a different fault handling procedure.

5. RECOVERY PROCEDURES

The recovery procedures task is to check whether a "not acceptable" classification should remain or not. The test are essentially the same as for the automatic test procedure and are performed at regular intervals for DCA:s in the categories "faulty" or "faulty and faulty isolated."

6. OPERATOR TOOLS

An operator may initiate procedures for fault verification, verification of fault clearance, blocking and un-blocking of DCA, intensified quality measurements, printout of supervision data and setting of alarm limits.

ANNEX 8

REPORT OF WT3

(Delayed Document JR (Sweden))ANNEX 9

(to the Report of WT3)

Suggested Reply to SGIII (TARIFFS)

SGXVIII has taken note of the results of the SGIII survey questionnaire on ISDN.

In reply SGXVIII attaches copies of draft recommendations I0210 - ISDN Architecture Functional Model and I0310 - ISDN Numbering and addressing principles. It is considered that these provide the best up-to-date view of SGXVIII on the network aspects of the ISDN.

A continuing exchange of views between SGIII and SGXVIII is considered to be beneficial to both series of studies.

Will send reply that we are working on matter

C.C.I.T.T.

A.163

Study Group XVIII
(Group of experts on ISDN matters)

Kyoto, 14-25 February 1983

SOURCE : Chairman of Working Team 4

TITLE : Report of the meeting on Services Q1,A/XVIII
(TD.50 was previous version.)

1) General

The group met under the chairmanship of Mr. P. Kahl (F.R. of Germany). The following contributions were identified to have relevance to Question 1,A/XVIII :

- . COM. XVIII No.69 (ITT), 104(CMTT), 115(Sweden), 116(ITT), 125(COMII), [129(COMIII)], 140(F.R.G.), 151(Sweden)
- . Delayed Contributions No. HE(F.R.G.), HF(F.R.G.), [HQ(NTT)], [GY(FRG)], [HW(NTT)], [HX(NTT)], HY(France), IE(France), IJ(USA), IK(USA), IL(USA), IM(USA), IN(USA), IO(ATT), [JB(KDD)], [JC(KDD)], [JF(Canada)], [JI(Canada)], [JL(Canada)], [JO(Canada)], [JR(Sweden)], [JY(Australia)], [KA(Australia)], [KC(Australia)], [KT(BT)]
- . Temporary Document No. 4 (COMVII), 6(COMVII), 8(COMXI), 9(COM XI), [12 (COMIII)], R8 (Munich report)

The following terms of reference as proposed by the chairman were agreed upon :

- . Principles of definition of services supported by an ISDN
- . Information types
- . Bearer Services - identification of Bearer Services
- description of Bearer Services
- . Telecommunication Services
- . Relation to existing services
- . Service oriented network requirements

2. Results of the discussions

2.1 Principles of definition of services supported by an ISDN

The discussions on this topic mainly took place in a joint meeting between WT4 (Services) and WT3 (Network) and was chaired by Mr. Pfyffer (CH). The results of this joint activity opened the possibility to draft a 'Draft Recommendation on Services Supported by an ISDN'. ^{Additional work} on this topic was done in a small drafting-group chaired by Mr. Ackzell(Sweden). The resulting draft Recommendation including the work described in section 2.3 below is given in Annex 1. It should be noted that the terms used in the Recommendation are provisionally and should be studied further from a terminology point of view.

2.2. Information types

After some discussions on the need to further study the concept of information types the group decided to maintain it for the time being. Based on the available contributions the text as given in COMXVIII R8 was amended with the objective to better clarify the difference between w- and u- type of information. It was also indicated that t-type of information being explained to be 'telemetry information' may not be satisfactory.

As proposed to use "teleaction" was not agreed since this term seems to be more restrictive than telemetry. For the studies are required to define it fully.

~~However a better wording could not be found.~~ The amended text on information types is given in Annex 2. *See also part 3.8 of TD 61. [Page A. 219] 222*

2.3 Bearer Services

Based on the available contributions, the bearer services as given in Table 1 could be identified to be relevant at that point in time. It should be noted that the classification described in Table 1 is based on the agreements for the "Draft Rec. on Services Supported by an ISDN" (see Annex 1). A subgroup was established, chaired by Mr. Wood, USA-ATT, with the task to prepare a detailed description of bearer services operating at bitrates applicable to the B and D channels at the ISDN user/network interface. Only these bearer services should be considered which are of prime interest during this study period. This does not preclude that further bearer services will be defined in the next study period. Results of these activities are incorporated in the draft Recommendation as given in Annex 1 (See section 2 of Annex 1). *In the course of these discussions, it was decided by Working Team 4 that* three areas require further study. First is the generation of a set of unambiguous, mutually exclusive possible values for each attribute. Second is the generation of a list of Additional Lower Layer Functions (ALLF's). A number of contributions to this meeting have suggested, either explicitly or implicitly, such ALLF's. Another possible source is the list of User Facilities given in CCITT Rec. 3.2. The third area is the generation of a list of Quality of Service attributes. One possible source is the Provisional list of quality of service attributes that Study Group VII has developed for data services.

Bitrate/Through- put	FRANCE							USA		F.R.G.			Sweden
	64K	64K ¹⁾	<64K ²⁾	<16K		nx64K n>3	1920K	64K	64K	64K	64K	1920K	
switched	O	O	O	O		O	O	X		O	O	O	covered by proposals of France and FRG
non switched	O	O	O	O		O	O		X	O	O	O	
circuit	X	X				X	X	X	X	X	X	X	
packet			X	X									
transparent	X		X	X		X	X	O	O	X		X	
non transparent		X						O	O		X		
performance													
without ALLF	O	O	O			O	O	O	O	O	O	O	
with ALLF	O	O	O			O	O	O	O	O	O	O	

Table 1 Identification of bearer services

- 1) Packet-switched on B-channel (PSB) O = optional
 2) Packet-switched on D-channel (PSD) X = required

Working Team 4 also considered
~~In this context special attention was given to future broad band services. Based on a contribution from NTT the group decided as a working basis that bitrates for broad band services should be evaluated based on:~~

n x 384 kbit/s

The main reason for agreeing to this approach is based on the fact that with this concept commonality between countries using the 1.5 Mbit/s hierarchy and countries using the 2 Mbit/s hierarchy can be achieved. The study of COMXVIII No. 104 from CMTT indicated however that there might be some difficulties with the linear encoding of sound signals which results in a bitrate of 448 kbit/s. Therefore CMTT is requested to reconsider its position in the light of the above proposal. Further studies and contribution of the above approach are required. (See also report of Working Team 1)

A.166

2.4 Telecommunication Services*WT 4 agreed that.*

In principle, an ISDN should be able to support as many as possible of the Telecommunication services provided by an Administration/RPOA. In particular examples of the Telecommunication Services already defined by CCITT, such as Telephony, Teletex, Videotex would be supported as well as further Telecommunication Services being defined by relevant CCITT Working Groups.

With the Service concept now defined in Rec. I. 0100 (See Annex 1) it seems not necessary for SG XVIII to go into the details of specifying various Telecommunication Services.

2.5. Relation to existing services

As a general principle the group decided that ^{for} ~~if~~ existing services, ^{which} would be supported by the ISDN the existing service characteristics will have to be provided by the

ISDN. Any change in characteristics would require a change in service definitions or definition of a new service.

In this context it was mentioned that SG.VII has not yet finished its quality of service recommendation for data services. The group therefore agreed that SG.VII should be asked to take into account the possible support of these services by an ISDN in their further work on quality of service.

Special attention should be given to the HRX for ISDN as given in G 104 and the I series Recommendations. In order to organize the future work on relation ~~to existing~~ services the following study items were proposed.

- services in the existing telephone network
- services in dedicated data networks
- use of existing terminals

Further work is necessary and the Administrations are requested to submit contributions.

2.6. Service oriented network requirements

- multimedia calls: The concept of multimedia calls as indicated in Delayed Contribution JO (ATT) was discussed. It was agreed by the group that this concept is required for the ISDN as seen from a service point of view. SG.XI is therefore asked to provide for the appropriate signalling facilities when defining the D-protocols. (see also report of Working Team 3)

and application part of signalling system # 7.

Service Interchange During a Call

Delayed contribution KT (British Telecom) proposed that ISDN users should be offered a 'universal call' service ie. a circuit-switched call established between two S/T reference points which would allow a change of service from voice to digital data (and vice versa) during the same call without any network reconfiguration. The point was made that such a change of service during a call would require the switching out (or in) of network circuit devices such as echo suppressors. where these were provided, when the service was changed from voice to digital data (or vice versa), ie the network connection would need to be non-transparent for voice, but transparent for digital data.

This led to considerable discussion as to whether, from a conceptual point of view, the 'universal call' with service interchange capability should be regarded as a third category of bearer service (the first two being transparent and non-transparent respectively), or whether the bearer service itself should be regarded as changing from the non-transparent category to the transparent category upon change of service from voice to digital data. One solution proposed that the 'universal call' should be regarded as a third category of bearer service, as a unique service identification code would have to be used at the time of call set-up; another solution proposed that one of the first two categories of bearer service should be used with change to/from transparency from/to non-transparency being effected by means of additional low layer functions.

No firm conclusions were reached and the item was left for further study.

- Compatibility check: In Delayed Contribution HQ (NTT) various possibilities of the realization of compatibility check are described. After some discussion it was agreed that this function would be required for Telecommunication services as described in Annex 1. The way of implementing this requirement was not considered to be relevant for the work of Working Team 4.

This report should be submitted to Study Group I, III, VII, XI, CMTT.

A.168

Annex 1

TD64

(to the report of Working Team 4)

I0100 Draft Recommendation on SERVICES supported by an ISDN

Considering

- . the ISDN concept described in general in Rec. G705
- . the technical concepts of ISDN described in the I ... series Recommendations

the ISDN will support a wide variety of services. In order to facilitate discussion of these services in relation to the network capabilities of the ISDN the following Recommendation is prepared.

1) BASIC CONCEPT

1.1. Services offered to customers connected to an ISDN can be characterized by

- . network provided functions
 - connections (CN)
 - Additional Low Layer Functions (ALLF)
 - High Layer Functions (HLF)
- . terminal functions
- . operational and commercial features associated with the service provision

1.2. To support services an ISDN provide (see Fig 1) the following network elements

- . Connections (CN)
- and optionally
- . Additional Low Layer Functions (ALLF)

It may also provide

- . High Layer Functions (HLF).

Dependent upon national regulations, HLF may be provided by Administrations, RPOA's or other suppliers. The HLF may be considered to be an integral part of the ISDN or may be considered to be outside the ISDN. In the latter case an interface will have to be specified between the ISDN and such an HLF entity.

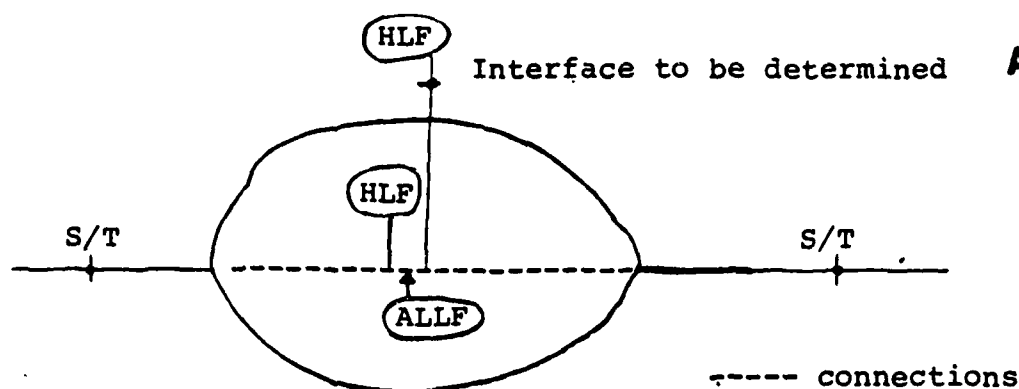


Fig. 1 ISDN network elements

An ISDN will provide a limited set of connection types to be used for a multiplicity of services. At reference points S/T a connection type is characterized by protocol layers 1-3.

An ISDN may provide "Additional Low Layer Functions (ALLF)" which are defined at reference points S/T by protocol layers 1-3.

Note: Signalling between the user and the network to request connections and/or ALLF may be characterized by a separate OSI-model, as described in Rec. I.0220.

'High Layer Functions (HLF)' supported by an ISDN are defined by protocols layers 4-7 at reference points S/T.

1.3 The following customer entities may be connected to the reference points S/T (see Fig. 2):

- customer terminals
- customer systems, e.g. PABX, LAN

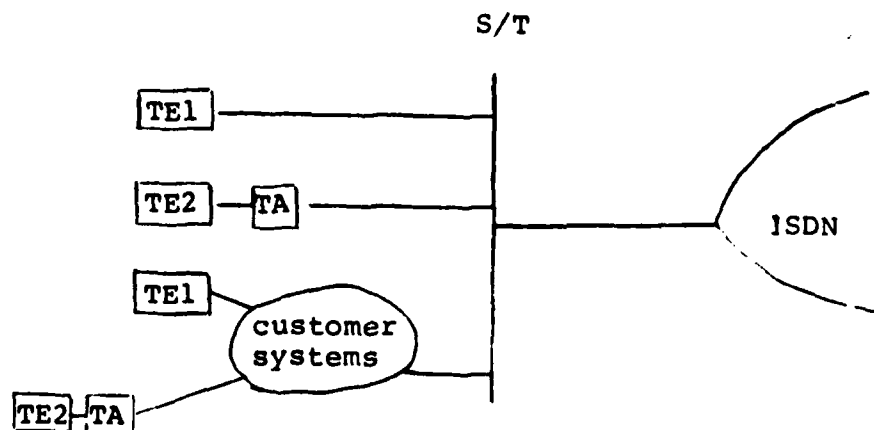


Fig. 2 Entities connected to S/T reference points

All customer entities connected to the S/T reference points must meet the interface specifications for layers 1 - 3 to be able to utilize one or more Connection Types in the ISDN. They must also meet the interface specifications for layers 4 - 7 if they utilize High Layer Functions (HLF) supported by an ISDN. Customer terminals and systems may be private or provided by Administrations/RPOA's.

1.4 An Administration/RPOA may offer to customers the following types of services supported by an ISDN:

- BEARER SERVICES, which use the connection types defined for an ISDN and, optionally, additional Low Layer Functions (ALLF). It should be noted that ALLF can not be offered as an independent service but only in conjunction with a connection type. The customer may choose any set of high layer (4-7) protocols for his communication, and the ISDN does not ascertain compatibility at high layers (4-7) between customers. An example of a Bearer Service is a 64kbit/s circuit-switched, transparent service.
- ALPHA SERVICES, which use the connection types defined for an ISDN, Additional Low Layer Functions (ALLF) as necessary, and High Layer Functions (HLF) supported by an ISDN. The customer must utilize all protocol layers 1 - 7 relevant both to the connection types and the High Layer Functions. An example of an ALPHA SERVICE is the access to and ~~operation~~ interaction with an information storage and processing facility.
- TELECOMMUNICATION SERVICES which are fully specified (protocol layers 1 - 7) including functions performed by the terminals. Telecommunication Services will use connection types defined for an ISDN, and optionally ALLF and/or HLF supported by an ISDN. The checking of high layer compatibility is part of this service. Examples of Telecommunication Service are Telephony and Teletex. It should be noted that a Telecommunication Service, e.g. Teletex, may utilize various connection types such as circuit or packet switched connections, in which case different terminals (at layers 1 - 3) may be required. It should be noted furthermore that for a Telecommunication service, the terminals may provide functions similar to ALLF or HLF supported by an ISDN. As an example abbreviated dialling can be supported by an ISDN as an ALLF or can be implemented in the terminal.

A.171

The concept of the types of services as seen from the customer's viewpoint is illustrated in Fig 3.

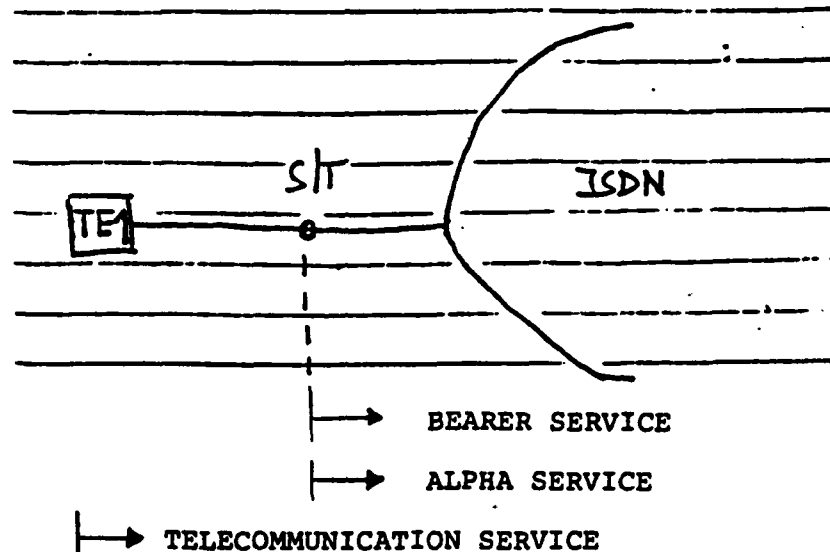


Fig 3 : Concept of types of services

Table 1 shows the types of services based on the various elements required.

ELEMENTS SERVICES	CN	HLF		Terminals	Operational and Commercial
		ALLF	ISDN based		
BEARER SERVICES	X	X _{opt}	-	-	X
ALPHA SERVICES	X	X _{opt}	X or	-	X
TELEC. SERVICES	X	X _{opt}	X _{opt} or	X	X

X = is defined as part of the service

X_{opt} = optional, dependent on specific service

- = is not defined as part of the service

Table 1 Definition of service types by the elements required

Examples of various service types are described in Annex 1

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2. Framework for Describing ISDN Bearer Services

Figure 4 presents a list of attributes proposed for use in describing ISDN bearer services. They are intended to be largely independent.

Attributes

1. Mode of connection
2. Bitrate/max. throughout
3. Establishment of Connection
4. Channel Type
5. Access Protocol
6. Symmetry
7. Connection Configuration
8. Bit Transparency
9. Additional Low Layer Functions Provided
10. Quality of Service Attributes

Fig.4

Fig. 5 presents a list of possible values for each attribute.

Possible values of attributes				Attributes
Circuit		Packet		Mode of Connection Bit-rate/ ^{Max.} throughput
bit rate options for further study		throughput options for further study		
Switched		Non switched	Reserved	Establishment of connection
D(16)	D(64)	B	Other options for further study	Channel Type
Access protocol options for further study				Access Protocol
Simplex		Duplex Symmetric	Duplex Non symmetric	Symmetry
point-to-point	point-to-multipoint	Others for further study		Connection Configuration
transparent		non transparent (may be further subdivided)		Transparency
under study				ALLF
under study				Quality of Service attributes

Figure 5
Possible Values for Each Attribute

[This page retyped by NCS.]

TD.64

3. Description of Bearer Services

This section described several bearer services accessed via a B and/or D-channel which may be provided by an ISDN. The description of subrate, broadband, and multiple-connection bearer services is for further study.

3.1 Circuit Mode Bearer Services

There ISDN bearer services are typically characterized by the provision of user information over one type of channel and signalling over another type of channel.

3.1.1 64 kb/s Circuit Switched Service - Transparent

This service provides for transport (without modification) of of 64 kb/s user information offered over a B channel. Signalling is provided over a D channel. Item 3.1.1 in TD.64--This replaces last sentence of 1st paragraph. The identification and description of possible additional services (such as, subrate or multiple configurations (e.g., multipoint, broadcast, conferences)) are left for further studies. These possible additional services should not lead to add additional requirements to those already identified for physical characteristics of interfaces to be applied to reference points S and/or T (see draft Recommendation I...). The identification and description of possible broadband services are also left for further study.

Attributes

1. Mode of connection: Circuit
2. Bit rate: 64 kb/s
3. Establishment of connection: Switched
4. Channel type(s): B for user information; D for signalling
5. Access protocol: Q.900 series for D channel
6. Symmetry: Duplex - Symmetric
7. Connection configuration: Point-to-point
8. Transparency: Transparent
9. Additional Lower Layer Functions Provided: For further study (1)
10. Quality of Service: For further study

Note 1: RPOA Selection, User-to-user Signalling, and Abbreviated Dialing have been suggested by a number of administrations. Point-to-multipoint is for further study. (?? to be finalized by de Haas, etc.)

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³
A.1.2 64 kb/s Circuit Switched Service - Non-Transparent

This service is similar to the transparent service (4.1.1) except that the network may use digital signal processing techniques, such as echo cancellation and low bit rate voice coding. Hence, bit integrity is not assured.(1)

Attributes

1 - 7. (Same as 4.1.1)

8. Transparency: Non-Transparent

9. Additional Lower Layer Functions Provided: For further study (2)

10. Quality of Service: For further study (2)

Note 1: Some indication of the user information type (e.g. voice) may need to be provided to the network, either at subscription time or on a call-by-call basis.

Note 2: May be different from corresponding values in 4.1.1.

³
A.1.3 64 kb/s Leased Circuit Service - Transparent³
A.1.4 64 kb/s Leased Circuit Service - Non-Transparent

³A.1.3 and ³A.1.4 are similar to ³A.1.1 and ³A.1.2, respectively, except that a connection is not established on demand via a set of signalling messages. Rather, the connection may be established at subscription time (i.e., non-switched) or at some time requested by the customer (i.e., reserved). Operational, administrative, and maintenance messages, related to these services may be conveyed over the D-channel.

³
A.2 Packet mode bearer services

These bearer services imply and involve packet switching resources of ISDN. Depending on the resources of the local access which are involved, three bearer services can be identified:

³
A.2.1 Virtual circuits established on a B-channel

The B-channel may be connected to the ISDN packet handling functions by means of a semi-permanent connection or switched on a per call basis. This service is equivalent to the one offered by the Packet Switched Data Networks, including the associated facilities (see CCITT Rec. X2).

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Attributes

1. Mode of Connection : packet-virtual circuit
2. Bit rate : the maximum throughput is one of the bit rates specified by recommendation X1.
3. Establishment of Connection: switched virtual circuit or permanent virtual circuit
4. Channel type : B for virtual circuits; D for signalling if circuit switched access to PHF.
5. Access protocol(s) : X.25 in B-channel; Q 900 series protocols for circuit switched access to the PHF
6. Symmetry : Duplex - Symmetric
7. Connection configuration : point to point
8. Transparency : Transparent
9. Additional Lower Layer Functions Provided: For further study, Candidates include those specified in CCITT Rec. X.2.
10. Quality of Service : For Further Study

³
4.2.2. Virtual circuits established in the D-channel.

These virtual circuits may be multiplexed with other information streams (e.g. signalling). Only some X.1 user classes (i.e., those asking for a throughput ≤ 16 kbit/s for a 16 kb/s D channel) can make use of that bearer service, with some additional restrictions (maximum user data for each packet, for example).

Attributes

1. Mode of connection: packet - virtual circuit
2. Bit rate: maximum throughput is one of the bit rates of Rec. X1 up to 9.6 kbit/s
3. Establishment of connection: switched virtual circuit or permanent virtual circuit
4. Channel type of : D channel at 16 kbit/s.
5. Access protocol: D channel (multipoint)

6. Symmetry: Duplex-Symmetric
7. Connection configuration: point to point
8. Transparency: transparent
9. Additional Lower Layer Functions Provided: For further study
10. Quality of Service: For Further Study

3

4.2.3 Connectionless Packet Service on a D-channel.

This service should be provided to support applications such as telemetry, telealarm and telecontrol. Further studies could indicate specific constraints on that Bearer service, such as technical performance or user throughput ; it can however be envisaged that it caters also for other applications (eg. Credit card checking).

Attributes

1. Mode of Connection: packet - connectionless
2. Bit rate: maximum throughput is one of the bit rates of Rec. X1 up to 9.6 kbit/s
3. Establishment of connection: switched
4. Channel type: D at 16 kbit/s - D at 64 kbit/s
5. Access protocol: For Further Study (1)
6. Symmetry: Simplex or duplex
7. Connection configuration: point to point or point to multipoint
8. Transparency: transparent
9. Additional Lower Layer Functions Provided: For Further Study
10. Quality of Service: For Further Study

Note 1: Candidates include the X.25 Fast Select option with restriction on answer, the X.25 Datagram Service, and others possibly not yet defined.

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Annex 1 to I0100

Examples of Services supported by an ISDN

The examples below refer to 64 kbits, circuit-switched connections. Other examples based on other connection types are equally valid. In the examples HLF are always indicated as being part of the ISDN. Other situations however may occur (see 1.2 of I0100)

1. BEARER SERVICES

The concept of BEARER SERVICES as described through the required ISDN network elements is given in FIG 6 and 7.

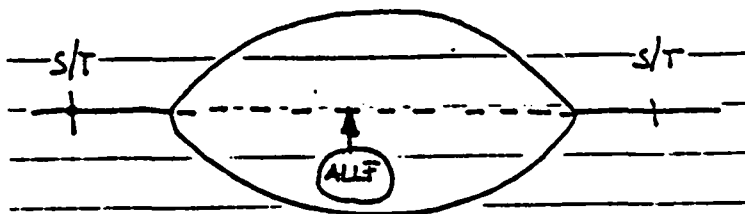


FIG 6 FUNCTIONAL MODEL

According to the definitions above the BEARER SERVICE does not include the terminals.

For a '64 kbit/s transparent/non-transparent circuit-switched bearer service' the protocol model as given in Fig 57 will apply:

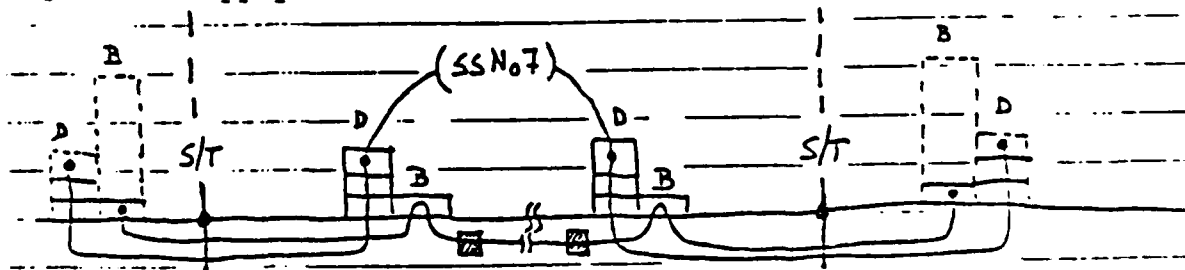



Fig. 7 Protocol model for 64 kbit/s circuit-switched Bearer Service

The inclusion of a level 1 bit-manipulator, () e.g. an echo-canceller results in a non-transparent connection type and consequently in a non-transparent BEARER SERVICE

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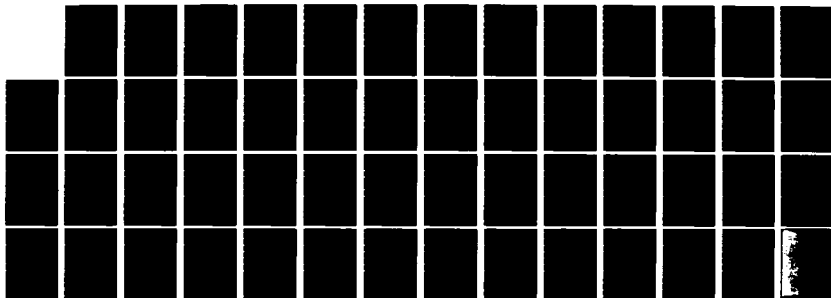
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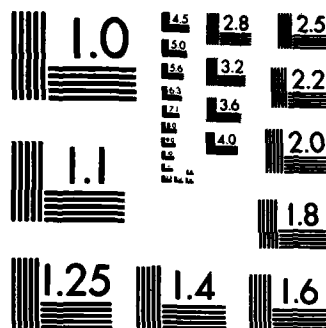
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2 ALPHA SERVICES

The concept of ALPHA SERVICES as described through the required ISDN network elements is given in Fig. 8, 9 and 10. According to the definitions above, the ALPHA SERVICE does not include the terminals

- a) In this case a connection is provided between two S/T reference points via an HLF

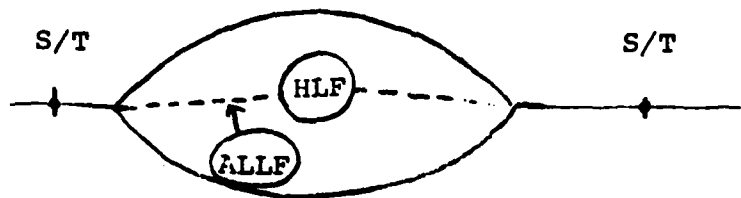


Fig. 8 Functional model

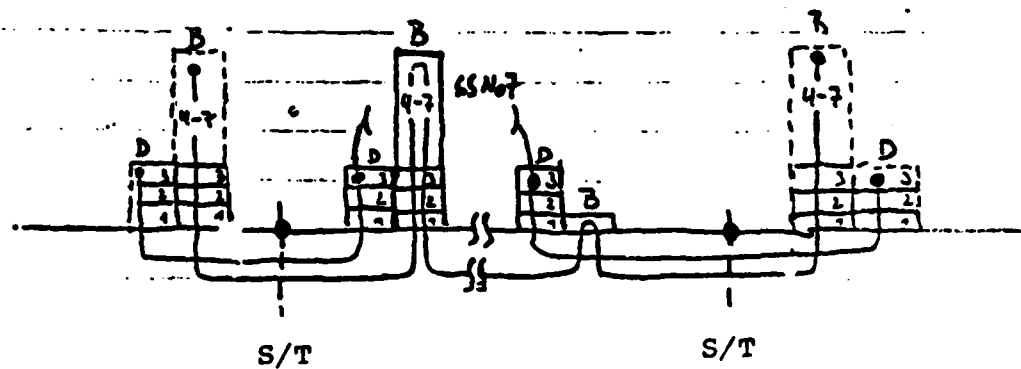


Fig. 9 Protocol model

- b) In this case a connection is provided between the S/T reference point and a HLF-element in the ISDN

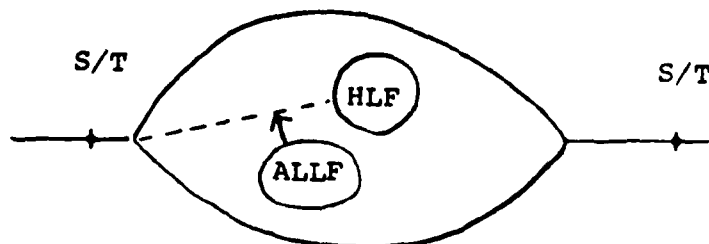


Fig. 10 Functional model

3. TELECOMMUNICATION SERVICES

The concept of TELECOMMUNICATION SERVICES as described through the required ISDN network elements is given in Fig. 11, 12, 13, 14, 15 and 16.

According to the definitions above the TELECOMMUNICATION SERVICE includes the terminals.

a. Teletex (64 kbit/s, circuit-switched) see Fig. 9 and 10

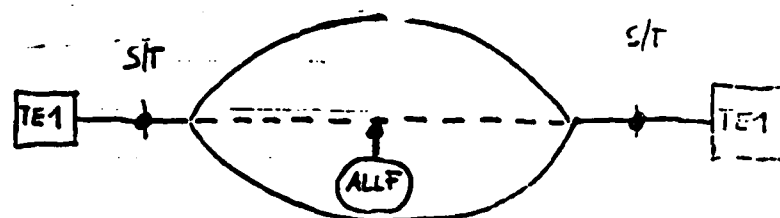


Fig. 11 Functional Model

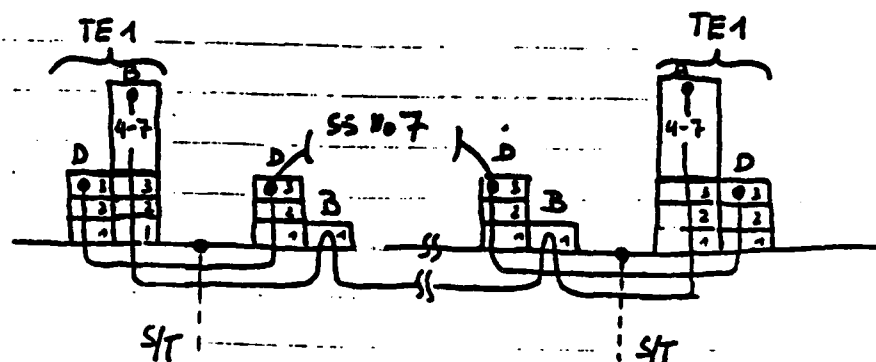


Fig. 12 Protocol model

(b) Videotex (64 kbit/s, "circuit-switched")

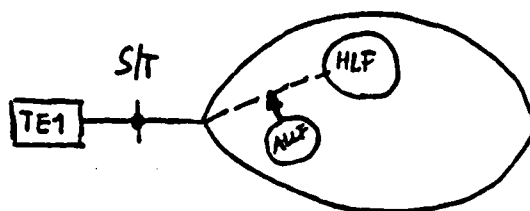
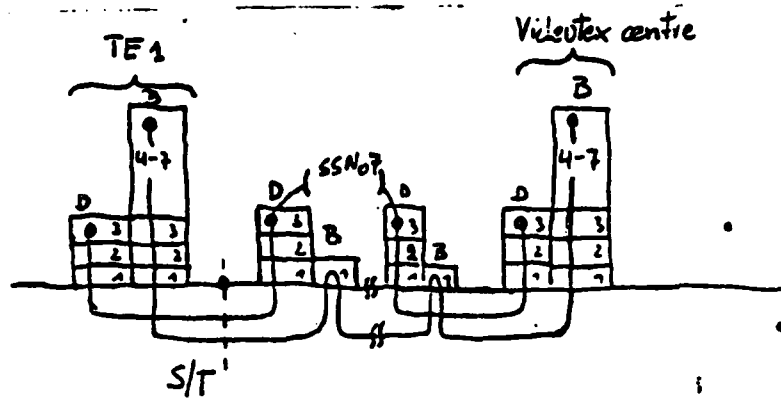


Fig. 13 Functional model



F Fig. 14 Protocol model

C) Message Handling Service (64 kbit/s, circuit-switched)

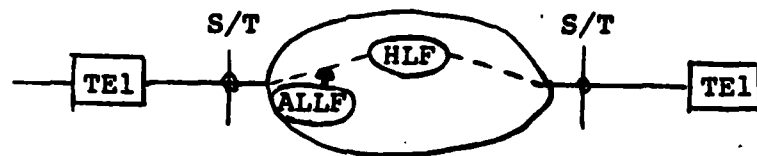


Fig. 13 Functional model

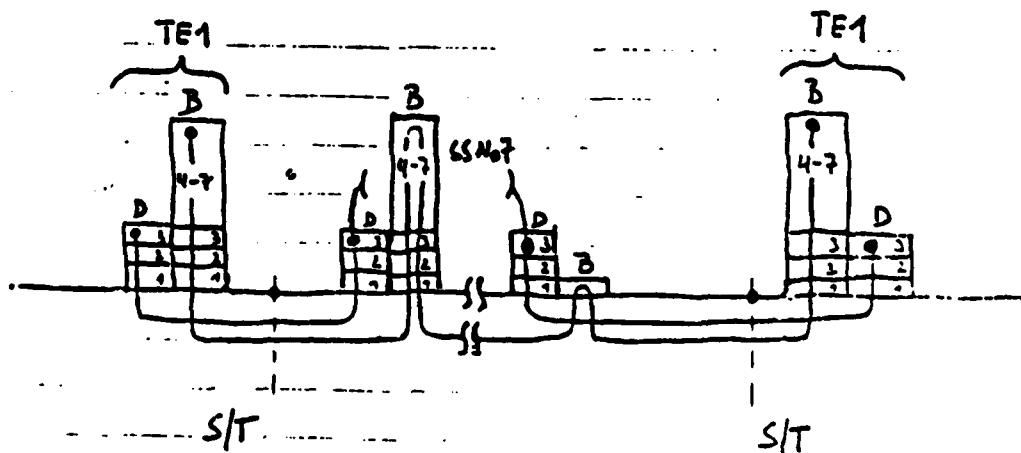


Fig. 15 Protocol model

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Annex 2

(to the report of Working Team 4)

Information types

Information types assists the progress in other ISDN study questions e.g. ISDN access types, network models prior to an agreement on individual services provided by an ISDN.

The definition of the information types takes into account service groupings, information rate and anticipated handling in the network.

The grouping of ISDN information types is not based on the principles as described above for the service classification. When ISDN services or classes of ISDN services have been defined these information types may not be further considered. Some of the information types below correspond to already standardized or agreed to services and/or rates, others to services and rates that are under study.

Type ^ag : signals corresponding to those from conventional (analogue) telephone subscriber stations (e.g., including decadic pulsing or multifrequency signalling (MFPB)).

Type v : encoded voice signals with subtypes as indicated below :

v1 - digital voice at 64 kbit/s, encoded in accordance with Recommendation G.711

v2 - digital voice encoded in submultiples of 64 kbit/s
(i.e. 8, 16, 32 kbit/s)

Note : Alteration of the transmission rate (variable bit rate voice) may be permitted during the duration of a connection.

v3 - digital voice at 64 kbit/s, where the encoding is not in compliance with Recommendation G.711 (e.g. high quality voice signals)

v4 - packetized voice up to 64 kbit/s

Note : Alteration of the transmission rate (variable bit rate voice) may be permitted during the duration of a connection.

Type d : digital information (other than v-type) up to 64 kbit/s with subtypes as indicated below :

d1 - digital data information at rates according to Recommendation X.1

d2 - digital information at 64 kbit/s

d3 - digital information at submultiple of 64 kbit/s
i.e. 8, 16, 32 kbit/s

Annex 2

(to the report of Working Team 4)

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Information types assists the progress in other ISDN study questions e.g. ISDN access types, network models prior to an agreement on individual services provided by an ISDN.

The definition of the information types takes into account service groupings, information rate and anticipated handling in the network.

The grouping of ISDN information types is not based on the principles as described above for the service classification. When ISDN services or classes of ISDN services have been defined these information types may not be further considered. Some of the information types below correspond to already standardized or agreed to services and/or rates, others to services and rates that are under study.

Type a : signals corresponding to those from conventional (analogue) telephone subscriber stations (e.g., including decadic pulsing or multifrequency signalling (MFPB)).

Type v : encoded voice signals with subtypes as indicated below :

v1 - digital voice at 64 kbit/s, encoded in accordance with Recommendation G.711

v2 - digital voice encoded in submultiples of 64 kbit/s
(i.e. 8, 16, 32 kbit/s)

Note : Alteration of the transmission rate (variable bit rate voice) may be permitted during the duration of a connection.

v3 - digital voice at 64 kbit/s, where the encoding is not in compliance with Recommendation G.711 (e.g. high quality voice signals)

v4 - packetized voice up to 64 kbit/s

Note : Alteration of the transmission rate (variable bit rate voice) may be permitted during the duration of a connection.

Type d : digital information (other than v-type) up to 64 kbit/s with subtypes as indicated below :

d1 - digital data information at rates according to Recommendation X.1

d2 - digital information at 64 kbit/s

d3 - digital information at submultiple of 64 kbit/s
i.e. 8, 16, 32 kbit/s

Study Group XVIII
(Group of experts on ISDN matters)

Kyoto, 14-25 February 1983

SOURCE : CHAIRMAN WT5

TITLE : REPORT OF WT5 PART 1.

1. AGENDA

The agenda shown in Annex 1 was adopted for the meeting. The Annex also lists the documents that were available for discussion.

2. REPORT OF DISCUSSIONS

2.1. D-channel requirements

A number of contributions were available dealing with various aspects of D-channel requirements. The following is a summary of the discussions and conclusions reached.

2.1.1 Signalling for B-channels in other structures.

Document R8 on page 104 records the discussion on this matter during the Munich meeting. At that meeting the question of multiple D-channels had been left for further study. At the present meeting discussions on access structures had confirmed a need, in the case say of a PABX connected to the ISDN by more than one primary multiplex structure, for a D-channel in one structure to be able to carry signalling for B-channels in another structure (on the same access).

The meeting discussed the implications of such an arrangement. Some delegates were concerned that at the switch it would be necessary to be able to identify the multiplex system that the B-channel is in. The meeting thought that this would depend on the implementation at the switch but would be an aspect that would have to be considered further.

The meeting agreed with the general requirement. In the same way that the D-channel of a basic access structure should be able to signal for say a broadband channel within the same access the D-channel of a multiplex channel structure should also be able to signal for other B-channels as the objective is that the same protocols are used. It was confirmed that in such an arrangement there was no requirement for the D-channel protocols to include signalling network management capabilities (e.g. message retrieval, change over, change back) as in SS No. 7. Some views were expressed that it would be desirable for the signalling to be able to be transferred automatically from one multiplex to another in the case of failure. The meeting thought that this should be catered for within the general network management procedures as the switch would likely be able to select which multiplex system on which to carry the D-channel to a customer. Such changeover could be manual, semi-automatic or automatic depending on the system monitoring and restoration techniques used. Some delegates, whilst agreeing with this approach for the 1984 Recommendations thought that such capabilities may be required in D-channel protocol in the future.

The meeting then considered the labelling implications of such a requirement.

Some delegates thought that the labelling should cater for the case when the D-channel is used in a second order multiplex structure. One figure mentioned was 128 channels. Others thought that the labelling should already allow for the identification of sub channels within a B-channel. It was agreed that as no definite limit could be put on the capacity SGXI should be asked to develop an open ended labelling structure possibly in two levels. The first level would primarily identify the B-channel and the second level sub-channels where appropriate. The eventual utilisation of such capabilities will depend on operational experience of large customer installations.

2.1.2 End-to-end Signalling

Two contributions were available on this subject. Document KG from British Telecom proposed that a limited capability for end-to-end (user-to-user) signalling be included in the signalling messages for B-channel call control. Document HG from the Federal Republic of Germany also proposed that such an end-to-end signalling capability be provided and in addition discussed the matter of conveying signalling between PABXs over the ISDN.

The meeting first discussed the proposal in document KG and agreed that such a limited capability should be included for end-to-end signalling between two ISDN customer installations.

Such a capability would typically be used in conjunction with the setting up of a B-channel connection and could be used for example for transfer of compatibility checking information prior to the initial communication. In addition, it could be used during an established call, for example for changing the operating mode of the terminals.

It was agreed that the transfer of such signalling messages containing end-to-end signalling information should also be possible when a B-channel connection is not present. In this case the 'virtual-call' procedure should be used in which the network handles the signalling messages as if a B-channel connection is involved and 'dummy' labels are used.

The meeting agreed that once a facility is provided for limited end-to-end signalling it would be desirable to also provide recommendations detailing how such information may be used by the customer installations as part of the definition of 'telecommunication services'. It was noted that there were charging implications in providing such end-to-end signalling capabilities. It was also noted that the amount of such end-to-end signalling as compared to call control signalling could be high in the case of short hold time calls. Flow control would thus be required in the network.

Concerning the amount of end-to-end signalling that should be catered for it was agreed that 32 octets maximum within the call control signalling messages would be a reasonable objective and Study Group XI will be asked to take such a requirement into account in the design of the D-channel protocols. The value of 32 octets was chosen primarily based on considerations of storage limitations in the network.

The following text based on the British Telecom contribution summarises the requirements:

SG XI should be asked to comment on their use for end-to-end signalling.

- i. A user data field of 32 octets maximum length should be provided in all messages used for call establishment and clearing at the user/network interface.
- ii. End-to-end signalling messages, each capable of transporting up to 32 octets of user data should be included in the D-channel protocols. (The transfer of these messages across the customer interface should not change the interface state with regard to call control.) Message transfer should be subject to the following rules:
 - a) A limited number* of messages may be exchanged between the calling and called parties following the transfer of the Call Confirmation Response/Indication message but before the called party accepts or rejects the call via the appropriate call control message.
 - b) Following the connection of the call it should be possible for parties to exchange a limited number* of end-to-end signalling messages.

* The limit on the number of messages that may be exchanged shall be controlled by the network in order to cater for charging policies and network flow control constraints.

iii. End-to-end signalling messages as described in (ii.b) above should be able to be used without any association with a B-channel connection (ie. for leased lines) using 'virtual B-channel' connection signalling procedures.

The discussion of end-to-end signalling for PABXs is reported in section 2.2.

The meeting then discussed the means by which the signalling messages carrying only the end-to-end signalling information field may be routed through the signalling network. Using the currently defined capabilities of SSNo7 the end-to-end signalling messages have to follow the path taken by the virtual (or real) B channel call set-up signalling messages even though no processing of the end-to-end signalling information need be performed at the transit exchanges. The end-to-end messages may be identified by allocating an appropriate heading code.

It would however, with some addition to the functions of the signal transfer points, be possible to establish a virtual circuit connection between the two local exchanges using only the signal transfer points.

Annex 3 provided by NTT describes the two cases and SG XI are asked to consider the possibilities of including the capabilities described in the SS No7 network.

2.1.3 Local Signalling

Contribution KJ from British Telecom was discussed in which it was proposed that features be included in the D-channel protocols to allow communication between terminals in a customers installation. For example such a communications capability would be required between the terminals on an intelligent NT2.

The meeting discussed the contribution and agreed that the ISDN user/network interface should be applicable to, for example, PABX extensions as well as to single terminal connections to the network. The aim should be however to incorporate any such additional features into the D-channel protocols in a consistent way and not try to cater for applications which would be incompatible with the 'standard' protocols.

In discussion it was noted that there may be addressing implications when considering local communication and it may also be desirable for the NT2 and terminals to be able to discriminate between calls within a customers installation and calls to/from the network.

The meeting agreed to ask Study Group XI, WP6 to investigate the impact of providing internal communication within a customer installation on the D-channel protocol, in particular layer 3, and to incorporate such features if they can be included with minimal changes to the protocols.

2.1.4. Simple Subset

Contribution HB from the Federal Republic of Germany was considered in which it was proposed that the same layer 1 and 2 protocols should be used for all applications of the ISDN user/network interface but that future evolution of the standard protocol, early implementation of national variants at layer 3 could be catered for by an 'escape' method.

The meeting discussed the issues raised and a number of delegates felt that until the studies of the D-channel protocols were complete it was not possible to exclude the possibility of defining a 'simple subset' of LAPD. It was not yet known that the LAPD presently being defined could economically meet all types of application. It was however reconfirmed that should such a subset still be required it should be compatible with the LAPD protocols.

Concerning layer 3 matters it was the view of the meeting that the aim should be to have a structured set of protocols at layer 3 which would cater for a range of applications. Some applications would not use all the protocols, for example a single terminal connected to the network would not utilize protocols included for PABX operation. Similarly, if the layer 3 protocols are designed with a number of protocol elements in them then 'simple' terminals could ignore some elements but still work to the same exchange terminations.

The general view of the meeting was that 'escape' techniques at layer 3 should not be encouraged and that if national additions to the protocols were necessary they should be catered for in the basic structure of the protocols. However it was noted that there may be a need to be able to allow for coexistence between early national versions of the layer 3 protocols and the standard layer 3 protocols. For this purpose 'escape' techniques could be applied.

The meeting reaffirmed the view that it was essential that the first objective was to define by 1984 a set of D-channel protocols including a layer 3 protocol structure which would allow for future expansion.

2.1.5 D-channel loading

The meeting considered Document HH from the Federal Republic of Germany which contained the results of D channel throughput calculations based on a number of assumptions on priority, message length etc.

It was noted that the conclusions in the document were in agreement with the approaches being adopted by SGXI. These were that priority between 2 messages should be provided at layer 1, that the layer 2 information field length should be limited to 128 octets and that frame abort mechanisms should not be included.

The meeting discussed whether or not two priority levels were sufficient. It was noted that SGXI had indicated that more than two could be provided. It was generally agreed that although there was as yet no detailed information indicating that more than two were required the option should be kept open.

The meeting agreed that 'S' type information should be given the highest priority and SGXI WP6 are asked to include this in the D-channel Recommendations. The meeting also endorsed the SGXI conclusions that the information field length should be limited to 128 octets and that frame ~~about~~ ^{abort} techniques were not required.

SGXI report also indicates that further study is needed on 256 octets (U.S.N.).

The matter of answer signal delay was raised and it was suggested that the D-channel protocols should allow priority to be given to some signals. Following discussion of this subject it was generally agreed not to discriminate between signal ~~es~~ in the D-channel protocols.

2.1.6 Performance

The meeting discussed the issue of signalling performance and reviewed document IU from Bell-Northern Research which raised the issue of the need to define overall signalling performance both to assist in the definition of signalling systems and to provide information to users of the ISDN.

It was agreed that SGXVIII should attempt to provide some overall signalling performance information based on a limited set of network models. It was noted that overall signalling performance will be influenced by the types of customer installation, by procedures adopted for call connect-through, by assumptions concerning the mix of signalling and data in the D-channels and by the network configurations. It was also recognized that signalling performance is only one aspect of defining overall service performance.

It was agreed that a drafting group be established under the chairmanship of Mr. B. Welsh (Canada-BNR) to provide a framework for such an analysis, which should include the parameters to be analysed and the signalling models to be used. The report of the group is contained in Annex 2 and contributions are requested for the next meeting.

2.1.7 Signalling for change of service during a call

Documents JC from KDD, JY from Australia and KT from British Telecom all addressed the matter of signalling implications of changing service during a call.

On the general issues raised in the documents the meeting concluded that the signalling requirements will depend on the definitions of 'bearer services' and network structures being defined under Question 1/XVIII points A and B. It was recognized that SGXI needs information on the necessary signals that will have to be conveyed in the network and the use to which they will be put. It was agreed that the matter be studied during the June 83 meeting in order to provide this information, and contributions are requested.

Concerning the particular points raised by SGXI contained in their report COM XI-R17 (see 4.7.2 of TD 21), the aim will be to consider the control of speech processing devices and the necessary signalling at the June meeting. Concerning the need for a 'data present' signal it was agreed that there was at this point in time no need for this particular signal but eventually a number of signals will be required which will characterize the connection.

2.1.8 Terminal Portability

The meeting reviewed the proposals in document KV from ITT and the general considerations on terminal portability contained in documents HI and IH from the Federal Republic of Germany.

It was noted that the term 'portability' had been used in a number of different senses and it was agreed that terminal portability in this discussion referred to the ability to be able to move a terminal from one socket to another on the same access channels during an established connection. It was not intended that the address of a terminal could also be 'moved'.

It was recognized that the part of the ISDN user/network interface definition will likely have to include the capability to detect that a terminal has been unplugged or is out of service during established calls and to clear any calls in progress. This matter however needs further study. Thus to ensure that a terminal may be moved an additional (level 3) signalling procedure would have to be included to hold the connections. Also it was agreed that there was a possibility that such a signalling procedure could have some compatibility with signalling procedures for transfer of a call from one terminal to another connected to the same access channels.

Following a discussion of the desirability for such terminal portability capabilities it was agreed that SG XI be asked to study the matter and include the necessary capabilities in the D-channel and SS No7 protocols. It was recognised however that there is a balance between the cost of providing such a capability and its value. Should it prove therefore to be a complex capability to incorporate SG XVIII may wish to review the requirement. It was also recognised that even if included in the ISDN user/network interface definitions not all terminals may wish to make use of such a capability. For example existing terminals connected via current interfaces and Terminal Adaptors may not be able to cope with a disconnection and reconnection.

The following additional requirements were agreed.

- a) Terminal portability should be applicable to both the calling and to the called terminals.
- b) Terminal portability was only required during the stable 'call connected' state, not during call establishment and clearing. Also, such a capability was not required during the 'ringing' phase.

2.2. PABX Signalling

2.2.1 PABX to PABX signalling requirements

Following the introduction of Document HG from the Federal Republic of Germany the meeting discussed the ways in which PABX to PABX signalling could be catered for. Four possible ways were identified.

a) The PABX end-to-end signalling is carried within the end-to-end signalling information field of the D-channel signalling messages (see section 2.1.2. above)

b) The PABX end-to-end signalling messages are carried within the D-channel but are identified as being different to the normal network call control signalling.

2.3 Layer 3 issues

2.3.1 Signalling for analogue channels

The meeting noted that in the discussions under Question 2/XVIII on hybrid access the opinion was expressed that it would be advantageous if the D-channel in a hybrid access arrangement could carry some or all of the signalling for the associated analogue channel.

There were no contributions available at the present meeting on which to base a discussion and it was agreed that the matter should be studied at the next meeting. Contributions are requested analysing the necessary signals and procedures for such signalling together with a comparison with the D-channel protocols. The meeting may then consider whether any elements of procedure could be added to meet such a requirement.

2.3.2 Connect through procedures

The meeting considered documents HR from NTT and JP from Canada and discussed the relationship between compatibility checking, charging and connect through. It was agreed that some clear guidelines were required on the extent of the network responsibility for compatibility checking in order that the appropriate signalling procedures may be defined. Studies are in hand under Question 1a/XVIII.

The meeting also discussed the particular issue raised in document HR on the connect through PABX. There are conflicting requirements as early connect through of a PABX to avoid speech clipping of the operators "answer" would give some possibilities of fraudulent use of the connection prior to the start of charging. It was agreed that further study was required of this problem and the attention of SGXI is drawn to this matter in the definition of layer 3 protocols.

Annex 4 contains an extract from document HR which discusses the options.

2.3.3 Direct dialling in to PABXs

Document HR also considered to possible ways of providing direct dialling in to PABX extensions. The options discussed were a) the extension number is transferred within the normal network number length, b) use of a sub-address in addition to the network number and c) use of signalling in the B-channel. The meeting discussed the issues raised. The general conclusion reached was that the total addressing arrangements being defined for ISDN under Question 1a/XVIII would enable S reference points and hence PABX extensions to be addressed. Should these arrangements require changes to the signalling protocols then these could be considered when the requirements are known. It was however noted that the limited end-to-end signalling capability that the meeting had agreed should be added to the call control signalling messages (section 2.1.2) would already provide for the transfer of sub-address information if necessary.

3. SUMMARY OF GUIDELINES AND COMMENTS TO SGXI.

~~(to be drafted)~~ See TD67 [page A.199]

c) The PABX end-to-end signalling is carried in the D-channel as 'p type' information.

d) The PABX end-to-end signalling is carried within B-channel established between the two PABXs.

Case a) has the advantage that no new features need be added to cater for PABX to PABX signalling but assumes that the throughput provided by the end-to-end signalling capability within the call control signalling messages is sufficient to meet the PABX signalling needs.

Case b) would have the advantage that it would be possible to handle such PABX-to-PABX signalling in the SS No. 7 signalling network in a different manner to network call control signalling e.g. for flow control or signalling routing purposes. The discrimination could be provided in the layer 3 signalling messages in the D-channel.

Case c) would be a possibility in networks which support p type information in the D-channel but the signalling performance would be determined by the characteristics of such a data service.

Case d) may be applicable for very large PABX but generally the inter PABX route size would not justify the provision of a B channel (or sub channel) for such a purpose.

The meeting agreed that more study was necessary on the requirements of PABX-to-PABX signalling in terms of signalling load but the general view was that case a) would be a good solution. An appropriate layer 3 discrimination may be needed in this case in order to allow distinction to be made between PABX to PABX signalling and end-to-end signalling (between the PABX extensions) at the PABX.

2.2.2 D-channel and E-channel compatibility

The working team on Question 2/XVIII had already confirmed the need to be able in some circumstances to connect a PABX to ISDN using the CCITT Signalling system No. 7 Message Transfer Part.

The meeting discussed the matter of commonality between the call control procedures that would apply in such a case and those that would be used if D-channel signalling was used. It was recognised that there were two aspects of such commonality, one is upwards commonality of the D-channel protocols and the other is commonality between the D-channel Layer 3 protocols for multiplex access and the call control protocols within the SS No. 7 User Part which would be used in the E-channel.

The meeting agreed that the first priority must be to have at the end of this study period a definition for a set of D-channel protocols including the layer 3 protocols for both basic and multiplex application of the D-channel including in a structured way the necessary additional protocol elements for PABX connection. Commonality between the D-channel layer 3 protocols and the E-channel "user part" *is also* ~~although very desirable, is of secondary importance.~~ SGX1 are therefore strongly requested to ensure that sufficient priority is given in the D-channel protocol studies to the definition of layer 3 protocols for multiplex access including the needs of PABXs.

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2.3 Layer 3 issues

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There were no contributions available at the present meeting on which to base a discussion and it was agreed that the matter should be studied at the next meeting. Contributions are requested analysing the necessary signals and procedures for such signalling together with a comparison with the D-channel protocols. The meeting may then consider whether any elements of procedure could be added to meet such a requirement.

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3. SUMMARY OF GUIDELINES AND COMMENTS TO SGX1.

~~(to be drafted)~~ See TD67 [page A.199]

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Annex 1

1. Introduction
2. Documents for discussion
 - 2.1 White Documents 12, 138, R8
 - 2.2 Temporary Documents 2, 6, 9, 12, 19
 - 2.3 Delayed Documents HB, HG, HH, HR, IS, IU, (JC),
(JP), (JY), (KB), KG, KJ, (KT),
(KV), (KX), LC
3. D-channel requirements
 - 3.1 Signalling for B-channels in other channel structures
 - 3.2 End-to-end signalling
 - 3.3 Local signalling
 - 3.4 Simple Subset
 - 3.5 D-channel loading
 - 3.6 Other
4. PABX signalling
 - 4.1 D-channel and E-channel compatibility
5. Layer 3 issues
6. Guidelines to other Study Groups
7. Issues for further study

Signalling ^{Performance} ~~Reference~~

1. The need for a framework to describe signalling performance characteristics for ISDN has been identified. The specification of a set of signalling performance parameters would serve two principal purposes, namely:

- . It would provide a basis for describing one aspect of ISDN services characteristics to users.
- . It would facilitate the development of appropriate signalling protocols and procedures.

2. As a first step, three elements have been identified as needing to be defined to describe signalling performance characteristics.

- a) one or more architectural reference model(s)
- b) assumptions concerning traffic characteristics on signalling links, e.g. p, t information on a D-channel.
- c) parameters (e.g. delay) which will appropriately describe the signalling performance of connections defined by the reference model(s), taking into account (b) above.

3. Contributions to provide a basis for the development of specification of performance characteristics are requested. Such contributions should include details of the architectural reference model assumed and the characteristics of traffic on the signalling links. As a basis for this work, the following sections detail some configurations which have been suggested as appropriate, and which should be considered as the basis for future studies.

4. Reference Models

Elements in a connection which will impact signalling performance, and which therefore should be included in a signalling network architectural reference model include

- number and type of signalling links e.g. satellite links
- number of signalling protocol end points and transfer points

Examples of connections:

- i) TE1 - local exchange - TE1
- ii) TE1 - passive bus - local exchange - passive bus -
TE1 in which the passive bus has 4 terminals connected
- iii) TE1 - local exchange - network - local exchange -
TE1 in which the network is represented by the HSRC
used for CCITT Signalling System No. 7 (see COM XI - R17
p.6-7)
- iv) TE1 - PABX - local exchange - PABX - TE1
The characteristics of this configuration may then
be extrapolated for other customer configurations such
as where more than one PABX (e.g. 3 layer 2/3 handlers)

ANNEX 3

End-to-End signalling message transfer procedures

- (1) The procedure shown in Fig. 1 can be realized with an STP which only provides MTP functions.
- (2) But, it requires all transit exchanges to establish a virtual circuit connection for end-to-end message transfer.
- (3) Furthermore, all transit exchanges within a virtual circuit connection have to receive and transmit all end-to-end signalling messages, though there is no need for the transit exchanges to process contents of end-to-end signalling messages.
- (4) If STPs provided a function to establish a virtual circuit connection between two local exchanges, as is shown in Figure 2, no function for end-to-end signal message transfer is required at each transit exchange.
- (5) If originating LS knows the SP code of terminating LS (which seems not to be difficult for a quasi-permanent virtual circuit connection), it can send an end-to-end signalling message directly to the terminating LS. In this case, no additional function is required both in STPs and in transit exchanges.

There is also a need to take into account the error performance of links. However to simplify the analysis in the first instance, error-free performance may be assumed.

5. Signalling Link Traffic Characteristics

The traffic carried on a signalling link will influence the performance, for example delay in accessing the signalling channel, processing time. One particular example is the packetized (p,t) data which may be carried by a D-channel. In defining the performance of signalling, assumptions of the traffic carried on a link will have to be stated.

Examples: (i) D-channel carried only signalling information
(assume maximum signalling message length of 32
octet and average of 16 octet)

(ii) D-channel also carried data at 50% capacity in
packets uniformly distributed in length between
0 and 128 octets (overall packet size), with
priority for S.

6. Performance Parameters

Two groups are of interest.

- . performance of individual links e.g. D-channel.
- . overall performance

An example of a parameter in the first group is the time to transmit a message between protocol end-points. In the second group, parameters of interest include 'call set-up time', time between terminal call accept and call cut-through, and 'time to clear a call'.

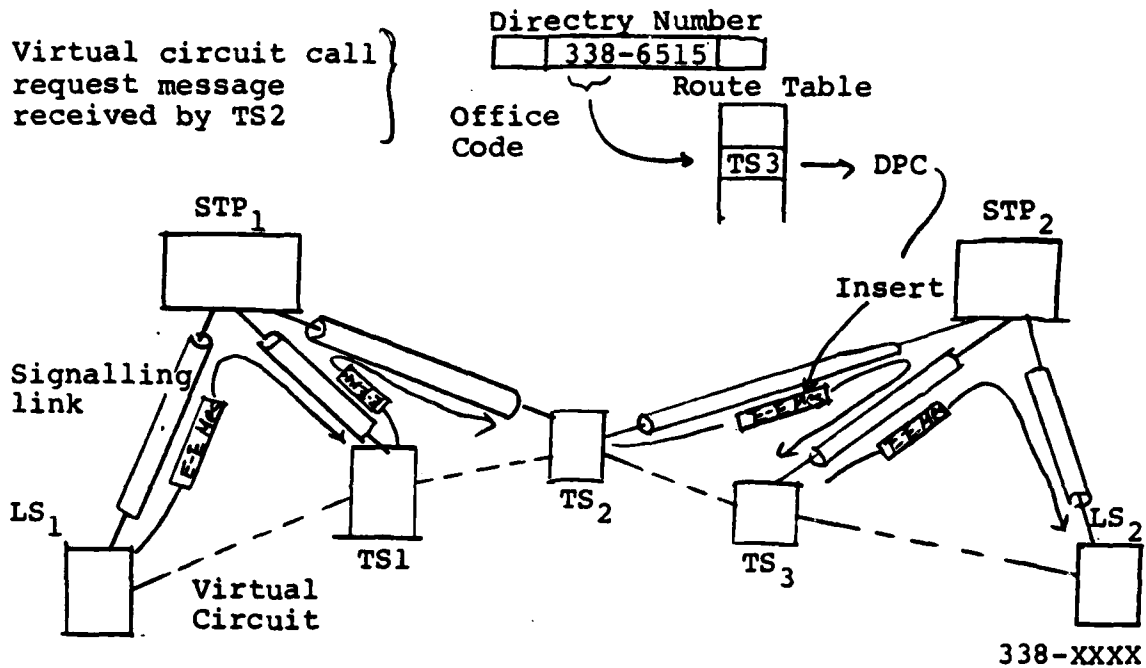


Figure 1. Virtual circuit via transit exchanges

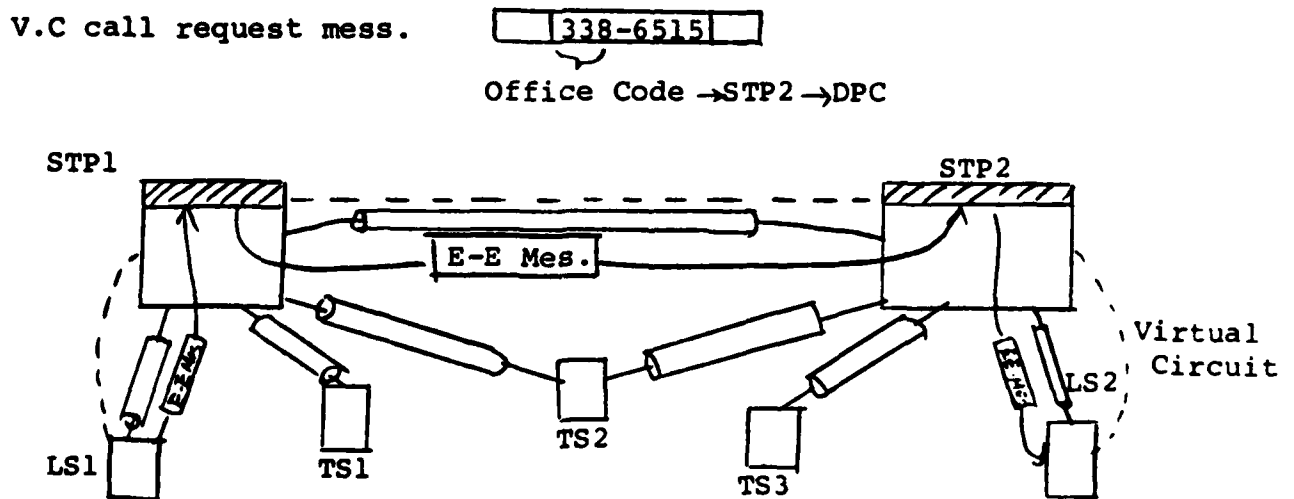


Figure 2. Virtual circuit via STPs

ANNEX 4

Points of switch through and duration charging start

Signalling sequences	Notes
<p>a)</p> <p>Ext. PBX Network PBX Ext.</p> <p>Ring Tone</p> <p>CR</p> <p>CI</p> <p>IC</p> <p>CC</p> <p>CA</p> <p>Ext. No. (via B-channel)</p> <p>Ring.</p> <p>Ans.</p>	<ul style="list-style-type: none"> - This sequence will be applied for operator-assisted Non-DDI PBX service. - It could be used for end-to-end extension dialing service via a B-channel. (See Table 2 (c))
<p>b)</p> <p>Ext. PBX Network PBX Ext.</p> <p>Ring Tone</p> <p>CR</p> <p>CI</p> <p>IC</p> <p>CC</p> <p>CA</p> <p>Ring.</p> <p>Ans.</p>	<ul style="list-style-type: none"> - Based on out-channel signalling. - No possibility of fraudulent use during the alerting period. - Possibility of voice clipping needs further study.
<p>c)</p> <p>Ext. PBX Network PBX Ext.</p> <p>Ring Tone</p> <p>CR</p> <p>CI</p> <p>IC</p> <p>CC</p> <p>CA</p> <p>Ring.</p> <p>Ans.</p>	<ul style="list-style-type: none"> - Based on conventional in-channel signalling. - Possibility of fraudulent use during the alerting period. - Small possibility of voice clipping than in case b).

⊗: Switch-through point

CR: Call Request

□: Start of duration charging

IC: Incoming Call

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C.C.I.T.T.

(Meeting of Experts on ISDN matters)
Kyoto 14-25 February 1983

SOURCE : CHAIRMAN OF WORK TEAM 5

TITLE : REPORT OF WORK TEAM 5. PART ~~3~~²

3. SUMMARY OF GUIDELINES AND COMMENTS TO STUDY GROUP XI.

The attention of SGXI is drawn to the following:

3.1 signalling implications of D-channels conveying call control signalling for B channels in other channel structures - section 2.1.1

3.2 development of an open ended labelling structure - section 2.1.1

3.3 inclusion of a 32 octet field in the D-channel signalling messages for end-to-end signalling - section 2.1.2

3.4 possible use of SS No. 7 network to establish virtual circuit connections using only STPs - section 2.1.2

3.5 inclusion of local communication capabilities and impact on D-channel protocols - section 2.1.3

3.6 comments on 'simple-subset' of D-channel protocols - section 2.1.4

3.7 priority for 'S' information in D-channel - section 2.1.5

3.8 comments on control of speech processing devices - section 2.1.7

3.9 inclusion of terminal portability capabilities and impact on D-channel and SS No. 7 protocols - section 2.1.8

3.10 the need to have D-channel layer 3 protocols for multiplex access (including needs of PABXs) by the end of the current study period - section 2.2.2

3.11 connect through procedures - section 2.3.2

4. CONTRIBUTIONS TO NEXT MEETING

The following is a summary of the subjects on which contributions are requested for the next meeting.

4.1 signalling performance analysis based on Annex 2.

4.2 signalling requirements for 'change of service' during a call - section 2.1.7

4.3 further information on PABX to PABX signalling requirements - section 2.2.1

4.4 analysis of impact of signalling for analogue channels on D-channel protocols - section 2.3.1

CCITT SGXVIII ISDN EXPERTS MEETING

A.201

Kyoto, 14-25 February 1983

Question: 5/XVIII

SOURCE: WORKING TEAM 6 CHAIRMAN (S. KANO)

Title: REPORT OF THE MEETING (Revised)

1. Introduction

Working Team 6 met 1-1/2 days under the chairmanship of Mr. S. Kano (NTT, Japan), to study documents relevant to Question 5/XVIII (switching in ISDN). List of participants appears in Annex 1. Relevant documents are identified in each of the following sections.

2. Approach to a specification of switching in ISDN

2.1 Documents

IC (France) compares advantages and disadvantages of specifying physical interface characteristics at reference point V and concludes that CCITT should specify them, saying at the same time that the specification should not preclude further integrated implementation, the physical implementation being not imposed.

GZ (FRG) proposes a reply to WP XI/4 to the effect that channel structures at V reference point should be limited to B+B+D, B+D and D.

Draft Rec. Q.5x3 (WPXI/4) proposes a reference configuration of a digital local exchange, which identifies a number of reference points.

LE (France) further describes the need to define functional, physical and electrical characteristics at V reference point, stating that CCITT has already identified V as a reference point at the conjunction of LT and ET functional groupings.

2.2 Discussion results

2.2.1 The meeting first agreed to the classification of exchange aspects into the following two categories:

Category A: Those aspects that affect characteristics as seen by a user at a user/network interface or by another network at an inter-network interface;
e.g. - protocols across such interfaces.

- transmission characteristics that affect the overall (user-to-user) performance such as error rate, delay, etc.

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- switching characteristics that affect the overall performance such as call set-up delay, blocking probability, etc.

Category B: Those aspects that do not affect characteristics at a user/network interface and/or at an inter-network interface, e.g.

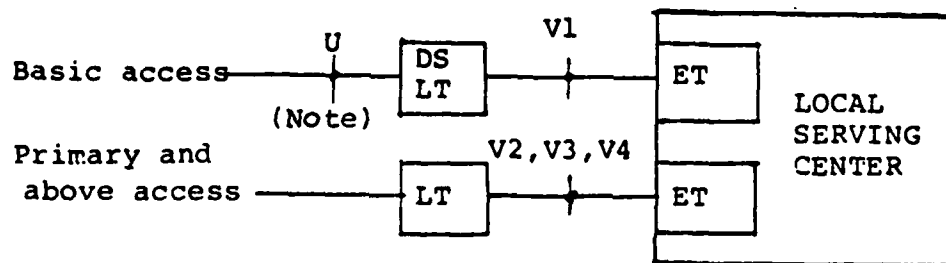
- interface channel structure at V reference point in Figure 1/Q.5x2.
- physical interface characteristics at the local exchange (subscriber side), etc.

2.2.2 It was agreed that Recommendations should be provided on category A aspects to assure as uniform a service to our customers as possible.

2.2.3 As for Category B aspects, two differing views were expressed:

- One view was that, since Category B aspects are strictly internal within a given network, specifications on them are fully within the competence of the provider of a given network and, therefore, there is no need for CCITT to specify them.
- Another view was that CCITT should provide a set of specifications which will give a network provider the freedom in the choice of manufacturers in the various component equipments within a network, while at the same time enabling a manufacturer to meet the demands of various network providers by a limited number of different equipments.

2.2.4 Discussion then concentrated on whether or not CCITT should specify physical interface characteristics at the exchange (subscriber side). Figure 1, which is an extract from Figure 1/Q.5x2, was used as a reference in the discussion.



(Note) In Figure 1/Q.5x2, the following note is attached as Note 2: Not subject to CCITT Recommendations.

(One administration expressed the view that this Note 2 should be deleted from Figure 1/Q.5x2 in case physical/electrical characteristics, will be defined by CCITT.)

Figure 1 - Extract from Figure 1/Q.5x2

2.2.5 For physical interfaces at reference points V2, V3 and V4 operating at 2048 kbit/s and above (if such interfaces exist physically), it was agreed that the electrical characteristics of these interfaces should comply with G. 703.

No discussion took place whether or not physical interfaces at reference points V2, V3 and V4 operating at 1544 kbit/s and above (if such interfaces exist physically) should comply with G. 703.

Further study is required on other characteristics of these interfaces e.g. channel structures etc, including the necessity and the approach to be taken by CCITT in specifying them. (See Section 2.2.6 below)

2.2.6 For exchange interfaces (subscriber side) corresponding to the basic access, the meeting identified the following 4 different approaches that could be taken by CCITT:

Approach A: Functional specification only, and no specification on physical and electrical characteristics, as is currently followed by SG XI.

Approach B: Physical characteristics at reference point V1 may be studied, but study results should not be given the same official status as other Recommendations specifying aspects that affect the overall performance (Category B aspects). One way to reflect this is to include them as Appendices to Recommendations with a possible title such as "A guide to ISDN implementation within a given network - Typical examples of internal network interfaces".

Approach C: Physical interface characteristics at reference point V1 should be recommended.

Approach D: Physical interface characteristics at reference point U should be recommended.

Note: In the opinion of a majority of Administrations, interface characteristics at reference point U is not a subject for CCITT Recommendations, as is stated in Note 2 of Figure 1/Q.5x2.

2.2.7 Concerning the above approaches on exchange interfaces (subscriber side) corresponding to basic access, a number of administrations expressed their preference to Approach A, or possibly Approach B. French administration supported Approach C and advocated further that the channel structure should be restricted to B+B+D. Administration of FRG supported Approach D, in case physical/electrical characteristics will be defined by CCITT. In the opinion of FRG administration, channel structures should be restricted to B+B+D in all approaches.

Some administrations expressed preference to have other channel structures in addition to B+B+D, such as B+D and D. Yet another administration expressed preference to have more flexibility at this point in time.

reach an agreement concerning the approaches described in section 2.2.6.

2.2.8 It was not possible to ~~take a decision on this matter, including the application of G.703 to exchange interfaces (subscriber side) operating at 1544/2048 kbit/s (V2, V3, V4).~~ The reason is that the issue was brought up by a delayed contribution made available only during this meeting and hence participants were not prepared to represent the view of their respective organizations.

3. Reduced rate B-channels within subscriber line transmission system

3.1 Documents

GZ(FRG) proposed that channel structures at V1 reference point should be limited to B+B+D, B+D and D.

KA(Australia) identifies a need for study on the provision of sub-64 kbit/s user rates, at least, at 32 kbit/s and 16kbit/s, in order to support user access configurations, where, for example, 64-32 kbit/s transcoder is located within the NT.

3.2 Discussion results

3.2.1 The meeting noted that there was an ambiguity within the present draft Recommendation I.XXY as to the possibility of reduced rate B-channel within a subscriber line transmission system. Two views were expressed:

- One view was that, since it is stated that padding bits used for rate adaption may not be conveyed by the network, the possibility of providing a reduced rate B-channel is allowed within the present agreements.
- Another view was that admitting such an approach was contrary to the "spirit" of present agreements.

3.2.2 After a discussion, the meeting agreed that the D-channel protocol should have the capability of accomodating reduced rate B-channels (8, 16 or 32 kbit/s) within the subscriber line transmission systems. It should be noted, however, that at a user/network interface and also when presented to the switching stage, reduced B-channels will be rate-adapted to 64 kbit/s. See Figure 1 below.

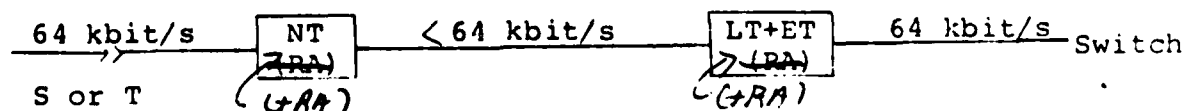


Figure 1 Reduced rate B-channel (8, 16 or 32 kbit/s) within subscriber line transmission systems

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3.2.3 Points raised during the discussion include the following:

3.2.3.1 Rate reduction techniques will be applied to reduce the transmission cost in long-haul transmission. If one has a long-haul subscriber line, e.g. a satellite circuit used as a subscriber line or a reach longer than can be catered for by an ordinary technique, there is a clear advantage in providing reduced rate B-channels within subscriber line transmission systems from economy point of view.

3.2.3.2 A terminal which requires a 64 kbit/s network connection cannot use such a B-channel that has not the capability to carry full 64 kbit/s. Therefore, a signalling arrangement has to be provided, in which an exchange will tell to a calling or called terminal whether or not the particular access arrangement over which the call is to be established has the required information carrying capacity. Even within the clear agreements so far reached, the definition of the access capability D (i.e. D-channel only) for the basic user/network interface requires this signalling capability and therefore it is not considered to be an additional complexity caused by the addition of reduced rate B-channels. WPXI/6 is requested to further investigate the signalling arrangements to cater for this capability.

3.2.3.3 As discussed above, reduced rate B-channel transmission has an immediate impact on signalling arrangements. As for its impact on switching, it depends on whether rate-adaption on the exchange side is considered to be a function of the LT or ET.

Some administrations expressed the view that it is a function of LT. One administration expressed the view that it is a function of ET. Yet another administration expressed the view that, at this point in time, sub-division into LT and ET is premature and that the rate adaption function should be considered as belonging to the LT + ET functional grouping. No conclusion was reached on this point in this meeting. The need for further study on this point depends on whether CCITT should provide specifications concerning V-reference point and, if so, in what way (only functional?).

3.3 Reply to WP XI/4 concerning channel structures at reference point V

(WPXI/4 asks if channel structures at reference point V can be limited to B+B+D, B+ D and D.)

3.3.1 A discussion took place concerning the need for specifying interface characteristics at the local exchange (subscriber side). WPXI/4 is asked to clarify what approach they envisage to follow in their study, taking into account various views described in Section 2.

3.3.2 SGXVIII draws the attention of WPXI/4 to the agreement reached in this meeting that the digital subscriber line signalling system should be designed in such a way to cater for the possibility of a reduced rate B-channel (8, 16 or 32 kbit/s) within the subscriber line transmission system. In view of the previous agreement (which was reconfirmed also by this meeting in I.XXY) that switching should be recommended to be performed at 64 kbit/s in this Study Period, rate-adaption function would be required at the exchange side, if reduced rate transmission is applied within the subscriber line. The decision on whether the rate-adaption function is to be considered as a function of LT or ET could not be made at this meeting.

4. Switching of sub-64 kbit/s channels

4.1. Documents

HA(FRG) proposes a reply to WP XI/4 to the effect that provision for switching of sub-64 kbit/s channels should not be recommended by CCITT.

IM(USA) proposes to study the provision of several sub-64 kbit/s least circuit connections multiplexed on one B-channel at the user/network interface (basic, primary rate, etc.).

KA(Australia) identifies the need to study sub-64 kbit/s connections in an ISDN, considering the recent progress in standardizing 32 kbit/s voice coding.

4.2 Discussion results

4.2.1 The meeting confirmed the previous agreements that sub-64 kbit/s switched connections are subject for further study in the next Study Period and not in this Study Period.

4.2.2 The meeting took note of the growing interest in sub-64 kbit/s connections expressed in US and Australian contributions. It also took note of the agreements arrived at during this meeting in other Working Teams on the need to recommend sub-rate multiplexing schemes on a B-channel and to study sub-rate leased circuit service capabilities.

4.2.3 In accordance with the previous agreements and at the same time considering the growing interest in sub-64 kbit/s connections, the meeting agreed to reply to WP XI/4 in a more positive wording than is proposed by HA(FRG).

4.3 Reply to WP XI/4

In reply to the request for clarification from WP XI/4 with respect to sub-64 kbit/s switched connections, SGXVIII reconfirms its statement in COM XVIII- No.R8. V/ 5iii. It is recommended that the provision for sub-64 kbit/s switched connections within a B-channel should remain as a subject for further study in the next Study Period and that Recommendations which are presently being drafted for digital exchanges may not include it. Attention is drawn, however, that it is the intention of SGXVIII

[This page retyped by NCS.]

TD.G6

to recommend sub-rate multiplexing schemes within a B-channel to be used for leased 64 kbit/s bearer services. (See draft Rec. I. XXV contained in this report.) Study Group XVIII draws the attention of Study Group XI to the agreement that on sub-64 kbit/s channels, octet structure will not be adopted. The implication of this decision on structure of digital exchanges needs to be considered relative to the definition of sub-64 kbit/s subchannels in the next study period.

5. B/D channel interworking for packet traffic

5.1 Document

JG(Canada) contains the study results on automatic diversion of packet calls from B to D-channel or vice versa, which are summarized in a Boolean tabular presentation.

5.2 Discussion results

5.2.1 Concerning packet calls, previous agreements were reconfirmed, which can be summarized as follows:

- packet calls can use either B or D-channel,
- calling and called packet terminals should be able to communicate with each other whether they use B or D-channel at their respective user/network interfaces.

5.2.2 A discussion took place on the need for automatic diversion of terminating packet calls at the called user side from B to D-channel or vice versa.

5.2.3 A view was expressed that the definition of busy/idle state of a packet channel (be it B or D-channel) needs to be established and that, in any case, the probability of encountering a busy state is much less than that for circuit switching.

5.2.4 Furthermore, procedures for automatic diversion would be complex. For example, a particular case is where terminating packet call on a B-channel is to be handled by a Packet Handler not colocated within the same local exchange which terminates the D-channel in question.

5.2.5 While appreciating the interesting and stimulating approach and study results presented in JG(Canada), the meeting agreed that the automatic diversion of a terminating packet call from a busy B-channel to an available D-channel, or vice versa, should not be the subject to be included in the Recommendations to be provided at the end of this Study Period.

6. D-channel handling functions

6.1 Document

JH(Canda) proposes a preliminary set of functional requirements for a central office D-channel handler.

6.2. Discussion results

6.2.1 The meeting noted that delayed JH classifies D-channel handling functions as a subset of functions belonging to the ET functional grouping. Therefore, it is considered as a useful input in the further study on functions to be allocated to LT and ET functional groupings and therefore the list of functional requirements appearing in the document is reproduced below for information:

- 1) Provide connection between user D channel terminals and low speed ISDN services including:
 - signalling
 - telemetry
 - public packet switched
 - dedicated
- 2) Limit dedicated service access to only those D channels which have subscribed to the particular service.
- 3) Implement a priority scheme for transmission of network to user D-channel traffic.
- 4) Route incoming calls to a particular D channel, in the *general* case where the handler serves many D channels as a *piece of common equipment*.
- 5) Determination of a busy/idle condition on a user D channel for calls originating from the network side.
- 6) Similar requirements for low speed channel *handling functions may* exist for hybrid access arrangements.

6.2.2 It was the common understanding of the meeting that D-channel handling functions will appear not only in ET, but also in a number of different locations and functional entities within and outside of a network.

7. Control of digital speech processing (DSP) devices

7.1 Documents

TD-9(WP XI./2), JC(KDD), JY and JZ(Australia) and KT(British Telecom) discuss various aspects concerning the control of DSP devices within a network.

7.2 Considering that the problem should first be studied from the total network point of view and has a more significant impact on signalling than on switching, and also that WT3 (Network) and WT5(Signalling) are studying it, the meeting agreed that, as far as WT6 is concerned, it is sufficient to draw the attention of WT XI/4 to the study results obtained in these other Working Teams.

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ANNEX 1

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Working Team 6, List of participants

<u>Name</u>	<u>Organization</u>	<u>Country</u>
S. KANO	NTT	Japan
F. RASTEGAR	TCI	Iran
J.M. HOGG	Dept. of Comm.	Canada
A.R. BASTIKAR	Dept. of Comm.	Canada
G.R. HOFFMANN	ITT	USA
D. VOEGTLEN	Siemens AG	FRG
W. KRAUTKÄUMER	Telefonbau u. Normalzeit	FRG
Y. TERADA	NTT	Japan
S. KOIKE	CIAJ	Japan
B. WIDE	Administration	Sweden
K.J. LIM	TELECOMS	Singapore
A. SANGAWITHY	Telecom Dept.	Sri Lanka
J. ODIET	Hasler AG	Switzerland
J.K. SONG	KOREA TELECOM, Authority	KOREA
Y.S. CHUN	KETRI	KOREA
O. DAHN	Administration	Denmark
O. BORGSTRÖM	ERICSSON	Sweden
A. EIDE	Telecom Adm.	Norway
A.P. ARNETH	ISO (Observer)	
I.M. LIFCHUS	AT&T	USA
P. BOSSU	CIT ALCATEL	France
D.S. HOOKER	BRITISH TELECOM	U.K.
H. BAUER	TEKADE	FRG
DE GOEDE	PTT	Netherlands
P. PEDERSEN	NORWEGIAN TELECOM	Norway
T. PLEVYAK	USA - BELL SYSTEM	USA
K. BRYN	NORWEGIAN TELECOM	Norway

(End of WT6 Report)

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C.C.I.T.T.

Temporary Document No. 56

Study Group XVIII

(Group of experts on ISDN matters)

Kyoto, 14-25 February 1983

SOURCE : Working Team 7

TITLE : Report of Working Team 7

1) Working Team 7 met under the chairmanship of Mr. H.K. Pfyffer (Switzerland) and took the following points as its terms of reference :

- Review of the structure of the I-series Recommendations
- Review of G705 (editorial matters)
- Review of I XXY
- Preparation of drafts for the introductory recommendations of the I-series

2) The following documents were used as a basis for the discussions :

COM XVIII No. R14; No.132; No.134
Delayed Contributions IA, IB

3) The results of the discussions are embodied in the introductory texts and the Recommendations I. 110, I.111 and I.120.
These texts are reproduced in the Annex.

4) It is proposed that ~~the~~ Annex¹ be sent to other Study Groups concerned with studies on ISDN - related matters for their information. (SGI, SGII, SGIII, IV, VII, VIII, IX, XI, XV, XVII)

5) It is intended that the Preamble be included in the document sent to these Study Groups, but should not be retained after the Plenary Assembly.

A.211

ANNEX I(to Report of Working Team 7) (*previous version was TD 33*)PROPOSED LAYOUT OF THE I-SERIES RECOMMENDATIONSPREAMBLE

ISDNs will evolve from IDNs for telephony. Many basic digital systems and network structures being developed for telephony and other networks are already covered by detailed Recommendations and may be used in ISDNs. Other Recommendations are in the course of being developed.

There are however many features which are specific to the ISDN, such as user/network interfaces, aspects which are related to the user perception of the ISDN (e.g. service related capabilities), network related aspects which are variants of or complementary to those pertinent to the telephony IDN, interworking aspects between the ISDN and dedicated networks, reference models for protocols and for network architecture. Furthermore an overview of essential ISDN characteristics is required for easy reference to assist the user as well as the provider of ISDN; therefore Recommendations concerning ISDN will attract a wide range of interest and the relevant information should be made available in *one* volume.

To cover these aspects Study Group XVIII, in its coordinating role on ISDN matters, proposes that CCITT establish a new ~~Recommendations~~ series, the I-series. This new series will contain ~~Recommendations~~ related to overall network aspects, user related ~~aspects~~ and protocols. Some of the Recommendations in the I-series will be provided and maintained by the appropriate Specialized Study Groups. Study Group XVIII itself will be responsible for other ~~Recommendations~~ of the I-series according to its terms of reference.

With the exception of Recommendation G.705, existing ~~Recommendations~~ in the Yellow Book will remain in their respective ~~series~~ (G,Q,X,V, etc.).

INTEGRATED SERVICES DIGITAL NETWORKS

(Overall network aspects and user related aspects and protocols)

An ISDN is generally understood to be a network evolved from the telephony IDN that provides end-to-end digital connectivity to support a wide range of services, including voice and non-voice services, to which users have access by a limited set of standard multi-purpose user-network interfaces.

This concept requires a family of CCITT Recommendations.

The I-series covers:

- the concept and principles of an ISDN
- service capabilities
- overall network aspects and functions
- user-network interfaces
- internetwork interfaces

The I-series Recommendations will provide principles and guidelines on the ISDN concept as well as detailed specifications of the user-network and internetwork interfaces. They will furthermore contain suitable references so that the detailed Recommendations on specific elements within the network can continue to be developed in the appropriate Recommendation series.

Recommendation I.110

GENERAL STRUCTURE OF THE I-SERIES RECOMMENDATIONS

PART I - GENERAL

Section 1 - Frame of I-Series Recommendations; Terminology

- I. 110 General Structure of the I-Series Recommendations
- I. 111 Relationship with other Recommendations relevant to ISDNs
- I. 112 Vocabulary (with Annex : Glossary of ISDN-terms)

Section 2 - Description of ISDNs

- I. 120 Integrated Services Digital Networks (ISDNs) (present G.705)

PART II - SERVICE CAPABILITIES

I.200 The structure is for further study. The contents could cover the following items:*

- concept of services, functional elements, etc.
- information types
- compatibility checking
- connection types (e.g. circuit and packet switched, etc.)
- user-to-user signalling
- tariff principles (refer to D-series)
- charging functions
- additional network capabilities (e.g. closed user group).
- terminal portability

I.2xx Services Supported by an ISDN

PART III - OVERALL NETWORK ASPECTS AND FUNCTIONS

Section 1 - Reference models

- I.310 ISDN functional architectural model
- I.311 ISDN protocol reference model
- I.312 ISDN Hypothetical reference connections

Section 2 - Numbering, addressing and routing

- I.320 ISDN numbering and addressing principles
- I.321 ISDN routing principles
- I.3xx Network connection types

Section 3 - Overall performance objectives

The structure and contents are for further study. The following is given as an example:

I.330 Overall performance objectives relating to circuit

switched connections

The structure is for further study. The contents could cover the following items:

- overall error performance (cf. G.821)
- overall controlled slip rate objectives (cf. G. 822)
- overall availability
- call set-up and clear-down time
- overall blocking probability
- etc.

I.331 Performance objectives relating to packet switched connections

The structure is for further study. The contents could cover the following items:

- overall error performance
- overall availability
- overall packet transfer delay
- overall packet loss probability
- etc.

Section 4 - Overall testing and maintenance principles

The structure and contents are for further study. (See also G. 704, X.150)

Section 5 - Evolution

The structure and contents are for further study.

PART IV - USER-NETWORK INTERFACES

Section 1 - ISDN user-network interfaces

1. General

- I.410 General aspects and principles relating to Recommendations on ISDN user-network interfaces (I.XXW)
- I.411 ISDN user-network interfaces - reference configurations (I.XXX)
- I.412 ISDN user-network interfaces - channel structures and access capabilities (I.XXY)

Section 2. Application of I-series Recommendations to ISDN user-network interfaces

The intention of this sub-section is to identify the relevant I-Recommendations that constitute particular ISDN user-network interfaces.

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- I.420 Basic user-network interface
- I.421 Primary rate user-network interface
- I.422 C-channel user-network interface

User-network interface for other channel structures
(for further study).

Section 3 ISDN user-network interfaces: Layer 1 Recommendations

The structure and contents are for further study. One example is as follows:

3. General

I.430 General aspects and structure of Layer 1 functions and protocols

- layer service characteristics
- modes of operation, e.g. point-to-point, point-to-multipoint
- requirements for specific user-network interfaces

3.1 Basic user/network interface

I.431 Basic user/network interface - Layer 1 specification

- functional characteristics
- procedural aspects
- mechanical aspects
- electrical aspects
- maintenance aspects

3.2 Primary rate user-network interface

I.432 Primary rate user-network interface - Layer 1 specification (see 3.1 above for aspects to be considered)

3.3 C-channel user-network interface

I.433 - C-channel user-network interface - Layer 1 specification
(See 3.1 above for aspects to be considered)

Section 4 - ISDN user/network interfaces : Layer 2 Recommendations

4. General

I.440 General aspects and structure of Layer 2 functions and protocols (could include reference to a simplified subset)

4.1 Layer 2 specification

I.441 Specification of Layer 2 protocol (Provisionally Q.920)

- layer service characteristics
- methods of operation
- overview description of Layer 2 functions and procedures
- frame structure
- elements and description of the procedures
- procedure-oriented and state-oriented graphical presentation
- maintenance aspects
- performance characteristics

Section 5 - ISDN user/network interfaces: Layer 3 Recommendations

5. General

I.450 General aspects and structure of Layer 3 functions and protocols (will include reference to protocols for connections of PABX, LAN, etc. and could include reference to a simplified subset)

5.1 Layer 3 specification

I.451 Specification of Layer 3 protocol (provisionally Q.930)

- layer service characteristics
- definition and function of information elements
- formats and codes
- call control procedures (overlap with I. 472 needs resolution)
- procedures for additional user facilities
- maintenance aspects
- modes of operation of the procedures, e.g. point-to-point and point-to-multipoint
- performance characteristics

The structure and contents of the Recommendations concerning protocols for connection of PABX, LAN, etc. are for further study.

Section 6 - User related testing and maintenance principles

I.460 The structure is for further study. The contents could cover the following items :

- user related testing and maintenance principles
- test loops
- fault conditions and alarms
- testing procedures
- etc.
- (cf. G.704, X.150)

A.216

Section 7 - Support of existing interfaces

7. General

I.470 General (this section refers only to CCITT recommended interfaces)

7.1 Support of X.21 and X.21bis DTEs

I.471 Support of Recommendation X.21 and X.21bis DTEs by an ISDN *

- hypothetical reference connections
- D-channel services
- mapping of X.21 and X.21bis interface signalling procedures to the D-channel services
- rate adaption and TA operation to effect synchronization

7.2 Support of X.25 DTEs

I.472 Support of Recommendation X.25 DTEs by an ISDN*

- hypothetical reference connections
- principles for DTEs accessing the B-channel (overlap with I.451 needs resolution)
- principles for DTEs accessing the D-channel (overlap with I.451 needs resolution)
- B/D-channel call handling

7.3 Support of V-series DTEs by an ISDN

I.473 Support of DTEs recommended in the V-series by an ISDN

- hypothetical reference connections
- principles for DTEs accessing the B-channel
- principles for DTEs accessing the D-channel
- rate adaption and TA operation to effect synchronization

PART V - INTERNETWORK INTERFACES

I.500 The structure is for further study. The contents could cover the following items :

- principles
- interworking between an ISDN, and
 - other ISDNs
 - analogue telephony networks
 - packet switched data networks
 - circuit switched data networks
 - mobile systems
- etc.

* Draft text already provided by Study Group VII.

Annex 2

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Recommendation I.111

Relationship with other Recommendations relevant to ISDNs

The I-series of Recommendations applies to the general concept and the network capabilities of an ISDN only in so far as they appear at user-network interfaces and internetwork interfaces. The ISDN interface specifications are covered in detail by the I-series Recommendations.

The specific aspects within the network and ancillary features that are necessary to support the above relating to, for example:

- technical characteristics of component parts and their performance objectives (e.g. transmission systems, switching systems, interexchange signalling systems)
- network synchronization
- maintenance and operation
- services
- tariffs and charging

will continue to be covered by the appropriate series of Recommendations.

Some of the existing Recommendations for telephony and other dedicated service networks are directly applicable also to ISDNs. However other Recommendations in these series may need to be developed in order to cover applications in an ISDN.

Some aspects which are relevant to an ISDN (e.g. performance) may be covered jointly :

- a) by an I-series Recommendation in so far as the overall characteristics as they appear at the user-network interface are concerned.
- b) by other Recommendation(s) in the appropriate series covering the characteristics of particular network elements.

move to end of text - [Page A.219]

Amendment to I.XXW (see XVIII. - No.132)

- Delete paras. 1.4 and 1.5 in the text of COM XVIII No.132.
- Amend in para 4, item 1) to read as follows :
 - 1) physical and electromagnetic (including optical) characteristics

Recommendation I.120 - INTEGRATED SERVICE DIGITAL NETWORKS (ISDNs)

1. PRINCIPLES OF ISDN

1.1. - The main feature of an ISDN is the support of voice and non-voice services in the same network. A key element of service integration for an ISDN is to provide a limited set of multipurpose user/network interface arrangements (see Parts IV and V of the I series of Recommendations) as well as a limited set of multipurpose ISDN bearer services (see Part II of the I series of Recommendations).

1.2. ISDNs support a variety of applications including both switched or non-switched connections.

Switched connections in an ISDN include both circuit-switched and packet-switched connections and their concatenations. As far as practicable new services introduced into an ISDN should be arranged to be compatible with 64kbit/s switched digital connections.

1.3. - An ISDN will contain intelligence for the purpose of providing service features, maintenance and network management functions. This intelligence may not be sufficient for some new services and may have to be supplemented by either additional intelligence within the network, or possibly compatible intelligence in the user terminals.

1.4. - A layered protocol structure should be used for the specification of the access to an ISDN.

Access from a user to ISDN resources may vary depending upon the service required and upon the status of implementation of national ISDNs.

1.5. - It is recognised that ISDNs may be implemented in a variety of configurations according to specific national situations.

2. - EVOLUTION OF ISDNs

2.1. - ISDNs will be based on, and evolve from telephony INNs by progressively incorporating additional functions and network features including those of any other dedicated networks such as circuit-switching and packet-switching for data so as to provide for existing and new services.

2.2. - The transition from an existing network to a comprehensive ISDN may require a period of time extending over one or more decades. During the transition period arrangements must be developed for the interworking of services on ISDNs and services on other networks (see Part III, Section 5 of the I series)*

2.3. - In the evolution towards an ISDN digital end-to-end connectivity will be obtained via plant and equipment used in existing networks, such as digital transmission, time-division multiplex switching and/or space-division multiplex switching. Existing relevant Recommendations for these constituent elements of an ISDN are contained in the appropriate series of Recommendations of CCITT and of CCIR.

2.4. - In the early stages of the evolution of ISDNs, some interim user network arrangements may need to be adopted in certain countries to facilitate early penetration of digital service capabilities.

(i) Some of those interim arrangements are recommended by CCITT, such as hybrid access arrangements.

(ii) Other arrangements corresponding to national variants may comply partly or wholly with CCITT Recommendations on ISDN. However, the intention is that they are not specifically included in the CCITT ISDN Recommendations.

2.5. - An evolving ISDN may also include at later stages switched connections at bit rates higher and lower than 64 kbit/s.

*Pick up H as amendment to I, XXW, from page 8,
[Page A.217]*

CCITT **A.220**

S.G.XVIII
(GROUP OF EXPERTS ON ISDN MATTERS)

Temporary Document No. 61

Kyoto 14-25 February 1983

Question: 6/XVIII

Source: Special Rapporteur for Question 6/XVIII

Title: Report of Working Team V

1. Introduction

Working Team V (Vocabulary) met on 21, 22 and 23 February under the chairmanship of the Rapporteur, Mr. P.G. Clarke of the United Kingdom.

The main task of the group was to agree a set of definitions of terms relevant to ISDNs to form the basis of the Recommendation on vocabulary in the I-series.

A list of participants is shown in Annex 1.

2. Documentation

The following documents were identified as relevant:

COM XVIII Nos. 139, 151

Delayed Contributions: HN, IE, IJ, IO, KC

Temporary Documents : 5, 17, 19, 21, 22, 31, 32, 42

3. Discussion

3.1 General aspects of ISDN terms and definitions

COM XVIII No. 139 and Temporary Document 17 were considered together as forming the basis for discussion of specific terms and definitions relevant to ISDN.

As a result of the discussion, Draft Recommendation I.113 was prepared, and contains the terms and associated definitions so far agreed.

It was noted that some important basic terms appear in other CCITT Recommendations in which they have definitions that are very specific to the particular application envisaged by the relevant Study Groups. These were considered alongside definitions of the same and related terms as produced by the International Electrotechnical Commission. In general the IEC terms were found to be more rigorous and confined to the essential points, forming a consistent set as a basis for the task of Working Team V. These terms and their definitions are shown in the Annex to Temporary Document 17. They have been incorporated in Draft Recommendation I.113.

Other Study Groups, in particular II, VII, and XI are invited as appropriate to consider the adoption of these basic terms and their definitions as contained in Section 1 of Recommendation I.113.

3.2 Specific terms

With reference to the terms DIGITAL NETWORK, CUSTOMER, and CUSTOMER-NETWORK INTERFACE, it was considered inappropriate for these to be defined by Study Group XVIII.

With reference to the terms TERMINAL EQUIPMENT and NETWORK TERMINATION, it was not possible to establish a clear idea of the essential concepts and the definition of these terms was left for further study.

3.3 Use of "-" and "/"

The view was expressed that "user/network" can be interpreted to mean "user or network" as well as "user to network", but not necessarily "network to user". It was agreed that, in order to clarify the position for the following conventions would be adopted. "User to network" and "network to user" apply only in the direction stated. "User-network" is bidirectional. "User/network" means "user or network".

3.4 Service Types

COM XVIII No. 151, Delayed Contributions IE, IJ, IO, KC, and Temporary Documents 21, 22, 31 and 32 have a bearing on the consideration of a formal definition of the terms BEARER SERVICE, ALPHA SERVICE, and TELECOMMUNICATION SERVICE. Some difficulty was found, however, in establishing the essential features of the ALPHA SERVICE with sufficient clarity to distinguish this unambiguously from the other two types of service.

It was agreed that all three service types should be left for further study pending clarification of the concept of the ALPHA SERVICE.

3.5 Access Types

The terms USER ACCESS and HYBRID ACCESS have been defined in the Draft Recommendation. It was agreed in principle that the term BASIC ACCESS should also be defined. However it was not possible to establish a definition at this time and the matter was left for further study.

3.6 Alternate Mark Inversion

Delayed Document HN contains a proposal that Study Group XVIII should adopt a new term ALTERNATE SPACE INVERSION in place of ALTERNATE MARK INVERSION in the Layer 1 Specification of the user-network interface. However, the relevant Draft Recommendation uses the term PSEUDO-TERNARY, so the problem would appear to have been solved.

3.7 Study Group VII Liaison

Temporary Document 19, Section 8 draws Study Group XVIII's attention to the difficulty of ensuring consistent terminology between Study Groups having common interests, and asks Study Group XVIII to offer proposals as to how this could be done. It was agreed that, in view of Study Group XVIII's overall responsibility for networks that provide many different types of service, it would seem appropriate for Study Group XVIII to take on the role of coordinating terminology.

As an initial step the definitions contained in Temporary Document 5, Annex A were reviewed and a reply to Study Group VII was prepared. It is associated in Annex 2 to this report.

3.8 Telemetry

The view was expressed that the term "telemetry" when used in its literal sense was too restrictive in its application. It was suggested that another term should be adopted to be applicable to low bit rate services in general including control and emergency alarm services etc. The term TELEACTION was tentatively proposed as a basis for further study pending submission of a formal contribution.

4. SUMMARY OF ITEMS FOR FURTHER STUDY

Establish definitions for the terms:

TERMINAL EQUIPMENT
NETWORK TERMINATION
BASIC ACCESS
BEARER SERVICE
ALPHA SERVICE
TELECOMMUNICATION SERVICE

5. SUMMARY OF INTERACTIONS WITH OTHER STUDY GROUPS

- (i) Draw the attention of Study Groups II, VII, and XI to Draft Recommendation I.113.
- (ii) Communicate the reply in Annex to Study Group VII.

ANNEX 1

LIST OF PARTICIPANTS

P.G. Clarke (Chairman)	United Kingdom
F. Bigi	CCITT
P. Bossu	France
T.Y. Kwon	Korea
K. Murano	Japan
R.L. Pokress	United States of America
D.L. Thomas	United Kingdom
R.W. Wilson	Canada
T. Yagi	Japan

REPLY TO STUDY GROUP VII

Study Group XVIII has considered the terms and definitions contained in the Draft Proposal for Revised Recommendation X.110, Annex A and has the following comments.

EXCHANGE -

In view of the possibility of multipoint calls, e.g. conference, the words "between two points" should be deleted.

CIRCUIT -

It is noted that this is identical to the IEV definition, and it has been quoted in Draft Recommendation I.113.

CONNECTION -

The IEV definition now considers a connection to be temporary. Study Group XVIII supports this view and accordingly Draft Recommendation I.113 quotes the new definition from IEV.

LINK -

The word "service" has implications that are not essential to the definition of the term. Study Group XVIII suggests that Study Group VII adopt the definition in Draft Recommendation I.113.

ROUTE -

TRAFFIC ROUTING -

CALL ROUTING -

CALL REROUTING -

The proposed terms and definitions are acceptable to Study Group XVIII.

ALTERNATIVE TRAFFIC ROUTING -

Study Group XVIII considers that the concept is correct, but that a formal definition should be produced.

STUDY GROUP XVIII

(Group of experts on ISDN matters)

Kyoto, 14-25 February 1983

QUESTION : 6/XVIII

SOURCE : SPECIAL RAPPOREUR FOR QUESTION 6/XVIII

TITLE : Draft Recommendation I. 113 - Vocabulary of ISDN Terms

1. INTRODUCTION

This Recommendation consists primarily of those terms and definitions that are considered essential to the understanding and application of the principles of an integrated services digital network (ISDN)

Included are some terms that are already defined in other CCITT Recommendations. However the definitions given here embrace only the essential concepts and on that basis it is considered that they are not inconsistent with the more specialized definitions that appear in those other CCITT Recommendations.

2. VOCABULARY OF ISDN TERMS**2.1. General****COMMUNICATION**

The transfer of intelligence or knowledge according to agreed conventions.

INFORMATION

Intelligence or knowledge capable of being represented in forms suitable for communication, storage or processing.

SIGNAL

A physical phenomenon or characteristic quantity of such a phenomenon whose time variations represent information.

ANALOGUE SIGNAL

A signal which follows continuously time variations of another physical quantity representing information.

DISCRETELY-TIMED SIGNAL

A signal composed of successive elements in time, each element having one or more characteristics which can convey information, for example, its duration, its waveform and its amplitude.

Note: Asterisks and underlinings should be deleted.

DIGITAL SIGNAL

A discretely-timed signal in which information is represented by a number of well defined discrete values that one of its characteristic quantities may take in time.

TRANSMISSION

The action of conveying from one point to one or more other points, information represented by signs, symbols, documents, pictures or sounds by means of signals.

(TRANSMISSION) CHANNEL

A means of transmission of signals in one direction between two points.

TELECOMMUNICATION

Any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.

(TELECOMMUNICATION) CIRCUIT

A combination of two transmission channels permitting transmission in both direction between two points.

SWITCHING

The process of temporarily associating functional units, transmission channels or telecommunication circuits for the purpose of providing a desired communication facility.

CONNECTION

A temporary association of channels or circuits, switching and other functional units set up to provide for the transfer of information between two or more points in a telecommunication network.

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2.2 DIGITAL NETWORKS

(TRANSMISSION) LINK

A means of transmission* with specified characteristics between two points.

(SWITCHING) NODE

A point at which two or more channels* or circuits* may be temporarily associated.

(TELECOMMUNICATION) NETWORK

A combination of nodes and links that provides connections* between two or more points to facilitate telecommunication* and possibly other functions.

DIGITAL TRANSMISSION

The transmission* of digital signals* from one point to one or more other points by means of a channel or channels that may assume in time any one of a defined set of discrete states.

DIGITAL (TRANSMISSION) CHANNEL

The means of digital transmission of digital signals* in one direction between two points.

DIGITAL (TELECOMMUNICATION) CIRCUIT

A combination of two digital channels permitting digital transmission in both directions between two points.

DIGITAL SWITCHING

The process of temporarily associating functional units, channels* or circuits* by means that may assume in time any one of a defined set of discrete states.

DIGITAL EXCHANGE

The whole of the means of implementing digital switching in order to provide telecommunication*.

DIGITAL CONNECTION

An association of digital channels or digital circuits, switching* or other functional units set up to provide means for a transfer of digital signals* between two or more points.

DIGITAL LINK

A means of digital transmission with specified characteristics between two points.

DIGITAL NODE

A point at which two or more digital channels or digital circuits may be temporarily associated.

INTEGRATED DIGITAL TRANSMISSION AND SWITCHING

The direct combination of digital transmission and digital switching.

INTEGRATED DIGITAL NETWORK

A combination of digital nodes and digital links that uses integrated digital transmission and switching to provide digital connections between two or more points to facilitate telecommunication* and possibly other functions.

INTEGRATED SERVICES NETWORK

A network that provides or supports a range of different telecommunication* services.

INTEGRATED SERVICES DIGITAL NETWORK

An integrated services network that provides digital connections between user-network interfaces in order to provide or support a range of different telecommunication* services.

2.3. ACCESS

USER (OF A TELECOMMUNICATION NETWORK)

A person or machine designated by a customer to use the services and/or facilities of a telecommunication network.

USER ACCESS

The means by which a user is connected to the network.

INTEGRATED DIGITAL ACCESS

A form of user access that uses only digital signals to convey information* related to one or more services between the user and the network.

HYBRID ACCESS

A form of user access that uses both digital signals and analogue signals to convey information* between the user and the network.

FUNCTION

A set of logical processes defined for the purpose of achieving a specified objective.

LAYER

A conceptual region that embodies one or more functions between an upper and a lower logical boundary within a hierarchy of functions.

Note: Each layer uses the services of the next lower layer, plus its own functions to create new services which are made available to the next higher layer."

PROTOCOL

A formal statement of the procedures that are adopted to facilitate communication* between two or more functions in the same layer of a hierarchy of functions.

ACCESS PROTOCOL

A defined set of procedures that is adopted between a user and a network to enable the user to employ the services and/or facilities of that network.

USER-USER PROTOCOL

A protocol that is adopted between two or more users in order to facilitate communication* between them.

INTERFACE

The common boundary between two associated systems.

USER-NETWORK INTERFACE

The interface between a user and a network.

LAYER INTERFACE

The common boundary between adjacent layers of a hierarchy of functions.

PHYSICAL INTERFACE

The common boundary between two equipments.

INTERFACE SPECIFICATION

A formal statement of the type, quantity, form and order of the interconnections and interactions between two associated systems.

PHYSICAL INTERFACE SPECIFICATION

A formal statement of the mechanical, electrical, electromagnetic and optical characteristics of the interconnections and interactions between two associated equipments.

INTERFACE STRUCTURE (CHANNEL STRUCTURE)

The number and type of the channels* that appear at an interface.

ACCESS STRUCTURE (ACCESS CAPABILITY)

The number and type of the channels* within the interface structure, that are actually available for telecommunication purposes.

TERMINAL EQUIPMENT

Definition for further study

NETWORK TERMINATION

Definition for further Study

FUNCTIONAL GROUP (FUNCTIONAL GROUPING)

combination of functions that may be performed by a single equipment

REFERENCE POINT

A conceptual point at the conjunction of two functional groups.

REFERENCE CONFIGURATION

A combination of functional groups and reference points that shows possible user access arrangements.

MULTIPOINT ACCESS

A system of user access in which more than one terminal equipment is supported by a single network termination.

ACCESS CONTENTION

A conflict between the demands made on a network termination in multipoint access.

ACCESS CONTENTION RESOLUTION

The arbitration of conflicting demands on a network termination in multipoint access.

END

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